SOIL SURVEY OF

Glasscock County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

HOW TO USE

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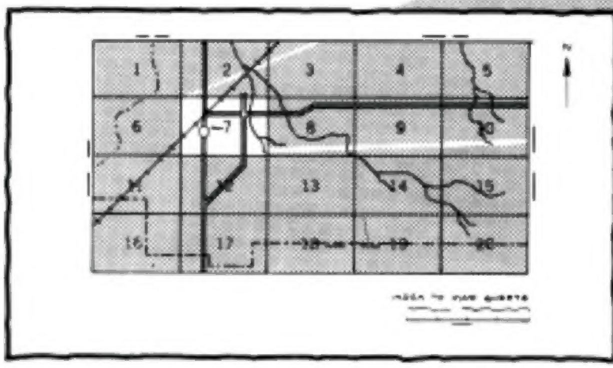

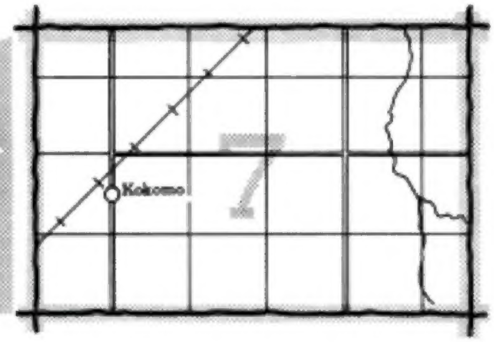

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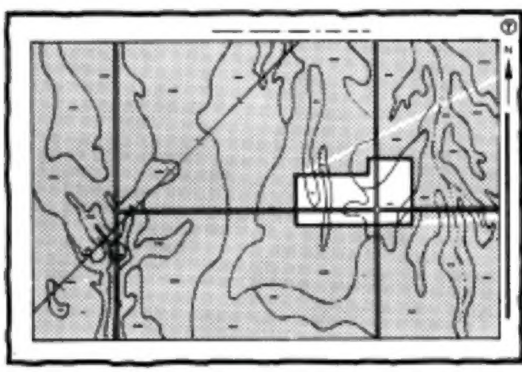

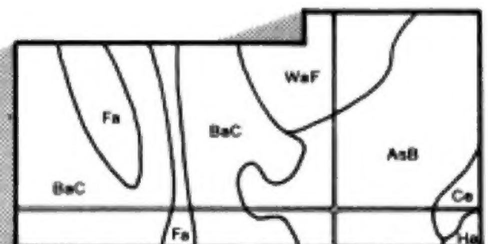

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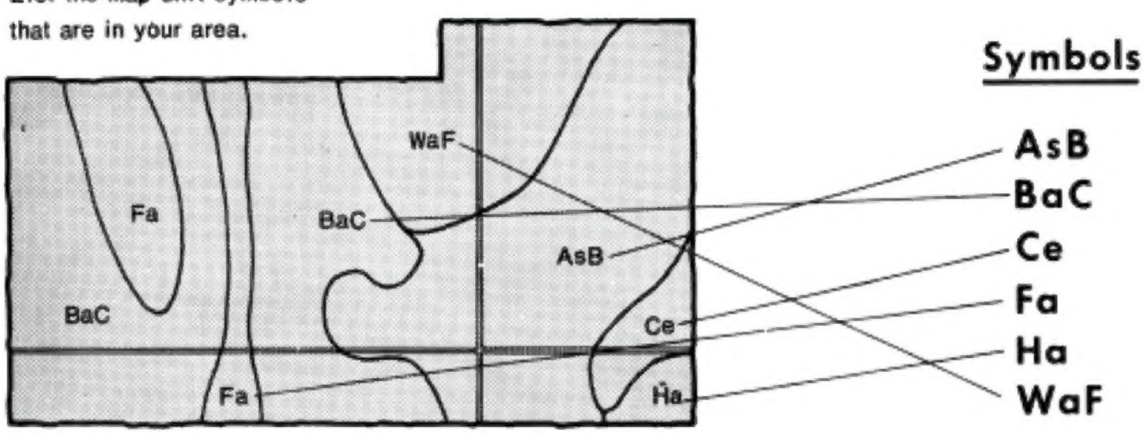
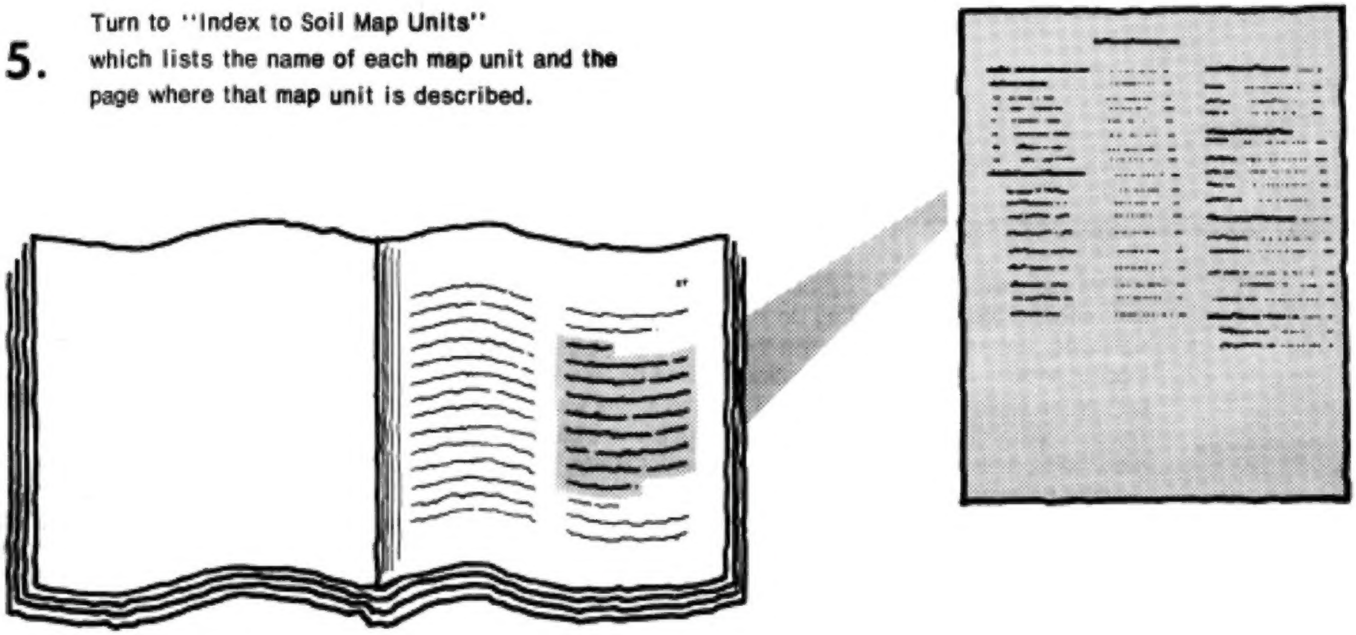
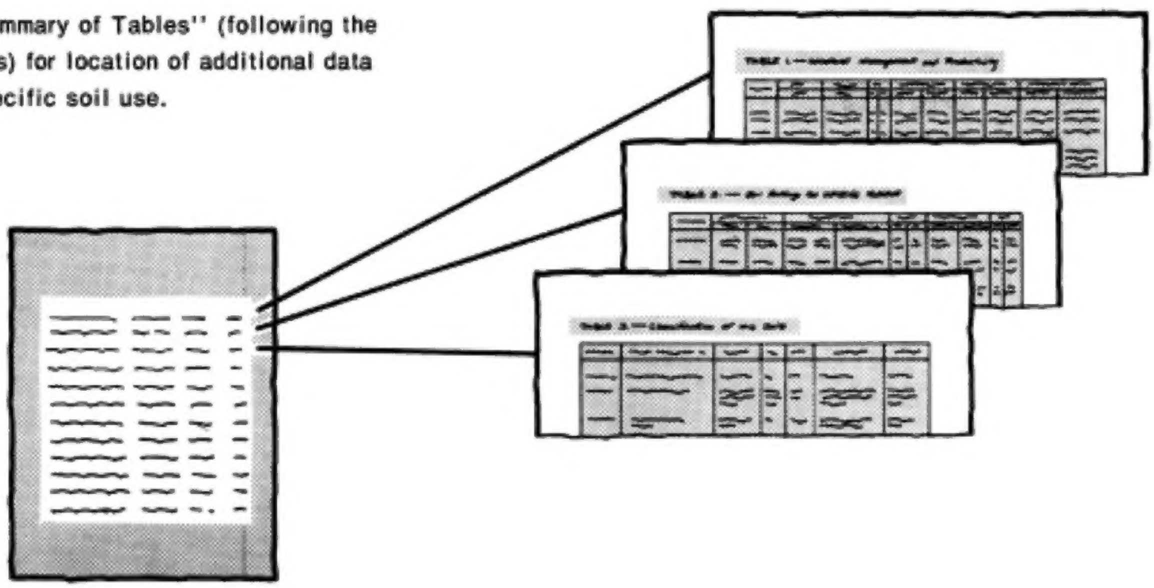


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1969-73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1973. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the North Concho River Soil and Water Conservation District and the Mustang Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Hereford cattle grazing on Clay Loam range site. The soil is Angelo silty clay loam, 0 to 1 percent slopes.

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Foreword

I would like to introduce the soil survey of Glasscock County, Texas. This publication can help you and your community to plan and to use wisely one of our most precious natural resources—the soil.

This soil survey is intended for many different users. It can help a homebuyer or developer determine soil-related hazards or limitations that affect homesites. It can help land use planners determine the suitability of areas for housing or onsite sewage disposal systems. This survey can help a farmer estimate the potential crop or forage production of his land. It can be used to determine the suitability and limitations of soils for pipelines, buildings, landfills, recreation areas, and many other uses.

Why do we need soil information? Many people assume that soils are all more or less alike. They are unaware that great differences in soil properties can occur within even short distances.

Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey soils are poorly suited to septic tank absorption fields.

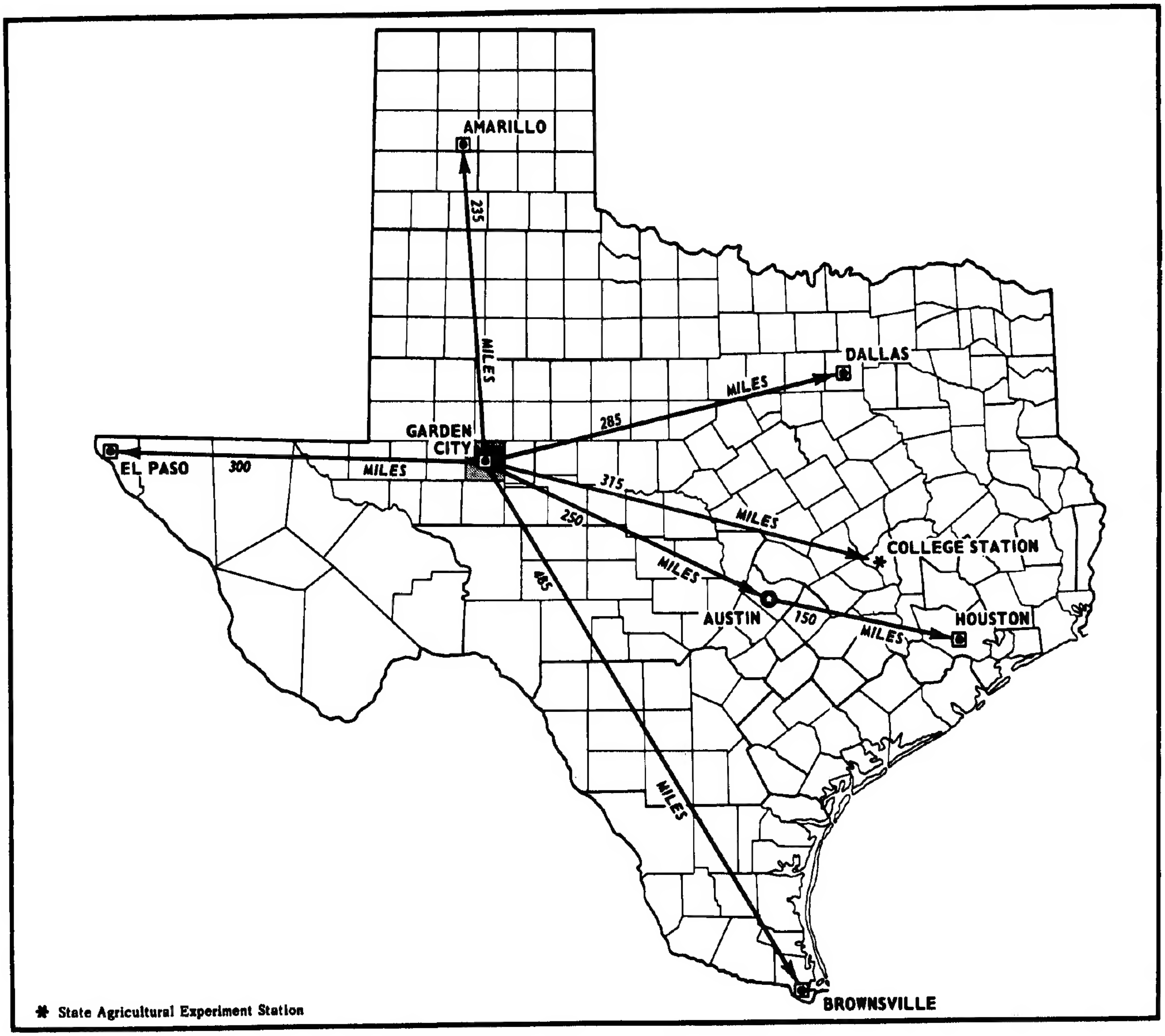
These and many other soil properties that affect land use are described in this soil survey. The survey also shows the location of broad areas of soils on the general soil map and the location of each kind of soil on detailed maps at the back of this publication. The publication provides descriptions of each kind of soil in the survey area, and much information is given about each soil for specified uses. Soil-related hazards, limitations, and potential for various land uses are highlighted.

We cannot explain here all the ways this soil survey can help you. If you need additional information or assistance in using this survey, please call your local office of the Soil Conservation Service or the County Extension Service. The soil conservationist or soil scientist assigned to the North Concho River Soil and Water Conservation District and the Mustang Soil and Water Conservation District or the county-extension agent can assist you.

I believe that this soil survey, along with other resource information, will enable you to have a better environment and a better life. The wide-spread use of this publication will greatly assist all of us in the conservation, development, and productive use of our soil, water, and related resources.

George C Marks

State Conservationist
Soil Conservation Service



Location of Glasscock County in Texas.

SOIL SURVEY OF GLASSCOCK COUNTY, TEXAS

By Marvin L. Dixon, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Texas Agricultural Experiment Station

Introduction

GLASSCOCK COUNTY is located in the southern part of the High Plains and in the northwestern part of the Edwards Plateau in the Great Plains region (see map on facing page). The total area is 552,960 acres, or 864 square miles. The county is a square, each side of which is about 29.4 miles long.

The area is generally a nearly level to undulating plain that slopes upward from the east to the west. The elevation rises from about 2,300 feet above sea level in the eastern part of the county to about 2,750 feet above sea level in the western part of the county.

Ranching is the main enterprise in the county. The county is about 88 percent range, 9 percent cropland, 2 percent pasture, and 1 percent urban land and water area. Beef cattle and sheep are the principal ranching stock in the county. Cotton and grain sorghum are the main cultivated crops.

The soils in this county formed under grass and are dominantly dark colored, loamy, and dry. Unprotected areas are subject to soil blowing and water erosion. The county experiences periods of drought typical of the southern part of the Great Plains.

General Nature of the County

In this section the settlement and population, climate, agriculture, and natural resources of the county are briefly described.

Settlement and Population

Glasscock County was created in 1887 from part of Tom Green County. It was named for George W. Glasscock, Sr., a prominent businessman. Garden City is the county seat. The total population of Glasscock County is approximately 1,150 people.

Climate

Glasscock County does not have an official weather station. The nearest official weather station is located in Big Spring, Texas, which is 27 miles due north of Garden City. For all practical purposes the climate of Glasscock County is the same as that recorded at the Big Spring station.

The climate is subtropical: it is dry in winter and warm and humid in summer. Rainfall averages about 16 inches annually. Most of this falls in the form of thundershowers during the period May through October when the prevailing south-southeasterly circulation carries Gulf moisture as far inland as West Texas. During the colder months, November through April, frequent surges of cold, dry polar air are effective in closing the Gulf source of moisture; therefore, rainfall or snowfall is quite limited. Thunderstorm rainfall in West Texas is extremely variable. Large differences in rainfall amounts exist from year to year and within relatively small geographical areas. The prevailing winds are southerly the year round, varying from southwest to south-southeast. The mean annual relative humidity is estimated at 76 percent at 6:00 a.m., 46 percent at noon, and 40 percent at 6:00 p.m. Seasonal variations in relative humidity are small. In an average year, Glasscock County receives 73 percent of the total possible sunshine. Mean annual lake evaporation is estimated at 72 inches.

Winter is a season of frequent surges of cold polar Canadian air that brings strong northerly winds and rapid drops in temperature. However, cold spells are of short duration, rarely lasting longer than 48 hours before sunshine and southwesterly winds bring rapid warming. Although freezes occur about two out of three nights, days are usually sunny, and daily maximums average about 59 degrees F. Winter is a dry season. Precipitation is in the form of light rain or drizzle, freezing rain, or snow flurries.

Spring is a season of frequent weather changes. Warm and cold spells follow each other in rapid succession throughout March and April. Strong, persistent southwesterly to northwesterly winds can infrequently produce dust storms in the area during these months. Thunderstorms, which rarely occur in winter, increase in number through the late spring. In spring, daily tempera-

ture maximums average about 78 degrees F, and daily minimums average about 51 degrees F.

Summer is a pleasant season. While afternoon temperatures are sometimes hot, most nights are pleasantly cool. Daily minimums are in the upper sixties and low seventies. Thundershowers occur on an average of six days each month. A few late spring and early summer thunderstorms may be accompanied by damaging winds and hail.

Fall is the most enjoyable season of the year, characterized by mild, sunny days and crisp, cool nights. Windspeeds are lowest during this season. Rainfall decreases progressively from September through November.

The warm season, or the freeze free period, averages 217 days. The mean dates of the last occurrence of 32 F or below in the spring and the first occurrence of 32 F or below in the fall are about April 4 and about November 7, respectively.

Agriculture

The main agricultural enterprises in Glasscock County are cattle and sheep ranching and nonirrigated and irrigated farming.

Cattle ranching, which was the first agricultural pursuit of Glasscock County, began about 1875. The availability of low cost land and good grass made the county especially suitable for raising livestock. Around 1890 to 1900, small areas of land were cleared and cultivated. Grain sorghum was the most important crop. Today, cattle ranching is practiced on an extensive scale and is the main enterprise.

Livestock operations are primarily cow-calf enterprises. Supplemental feeding is generally heavy. Stock are fed from December through late February or March. Calves are often sold on a contract basis with delivery dates in the late spring or early summer.

Cotton and grain sorghum are grown on medium-sized to large, fully mechanized farms. On these farms, raising livestock is a minor enterprise.

Natural Resources

Soil is the most important natural resource in the county. Livestock forage and food and fiber for market and home consumption are the major sources of livelihood of the people.

Oil and gas are obtained from numerous wells in the county and provide a major source of income to some landowners. They also provide revenues for the operation of public facilities.

Several irrigation wells supply water for supplemental irrigation of crops.

Caliche is plentiful in the county and is mined commercially. It is used mainly in local road construction.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps would identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has been changed very little by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Soil series commonly are named for towns or other geographic features near the place where they were first observed and mapped. Midessa and Reagan, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in characteristics.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Midessa fine sandy loam, 0 to 1 percent slopes, is one of three phases within the Midessa series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a named soil phase.

Some mapping units are made up of soils of different series or of different phases within one series, and some

have little or no soil. These kinds of mapping units are discussed in the section "Soil Maps for Detailed Planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. Existing ratings of suitabilities and limitations (interpretations) of the soils are field tested and modified as necessary during the course of the survey, and new interpretations are added to meet local needs. This is done mainly through field observations of behavior of different kinds of soil for different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and other information available from state and local specialists. For example, data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so as to be readily useful to different groups of users, among them farmers, managers of rangeland, engineers, planners, developers and builders, homebuyers, and those seeking recreation. The detailed information is presented in an organized, understandable manner in this publication.

Soil Map for General Planning

The general soil map at the back of this publication shows, in color, the soil associations described in this survey. Each soil association is a unique natural landscape unit that has a distinctive pattern of soils and relief and drainage features. It normally consists of one or more soils of major extent and some soils of minor extent, and it is named for the major soils. The kinds of soil in one association may occur in other soil associations, but in a different pattern.

The map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas of the county for general kinds of land use. From the map, areas that are generally suitable for certain kinds of farming or other land uses can be identified. Likewise, areas with soil properties distinctly unfavorable for certain land uses can be located.

Because of the small scale of the map, it does not show the kind of soil at a specific site. Thus, this is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure because the kinds of soils in any one soil association ordinarily differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Descriptions and Potentials of Soil Associations

The six soil associations in Glasscock County are described in the following paragraphs.

1. Reagan Association

Deep, nearly level and gently sloping, calcareous, loamy soils on uplands

This association is made up mainly of nearly level to gently sloping soils. Slopes are 0 to 3 percent. The association makes up about 36 percent of the county. Reagan soils make up about 92 percent of the association and less extensive areas of Angelo, Bippus, Conger, Lipan, and Midessa soils make up the remaining 8 percent (fig. 1).

Reagan soils are on broad plateaus, in valley fill, and on alluvial fans. These soils have a surface layer of friable, moderately alkaline silty clay loam about 10 inches thick. This layer is dark brown in the upper 4 inches and brown in the lower 6 inches. The next layer is friable, moderately alkaline silty clay loam about 19 inches thick. It is brown in the upper 9 inches and light brown in the lower 10 inches. Between the depths of 29 and 58 inches, the soil is friable, moderately alkaline, pink clay loam. It is about 40 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate. Between the depths of 58 and 80 inches, the soil is friable, moderately alkaline, reddish yellow clay loam and is about 20 percent, by volume, calcium carbonate.

The deep Angelo and Midessa soils are loamy and are on nearly level to gently sloping uplands in the association. The deep, loamy Bippus soils are in nearly level drainageways and on outwash fans. The shallow Conger soils are loamy and are on gently sloping ridges along natural drainageways and around playas. The deep, clayey Lipan soils are on the nearly level bottoms of depressions or shallow playas.

The soils of this association are used mainly for range, but some areas are cultivated.

Potential for cultivated crops is high. Low rainfall and soil blowing hazard are the most restrictive factors. Most cultivated areas are irrigated from wells with limited supplies of water. Cotton and grain sorghum are the main crops.

Potential for range is medium. Native range plants are mainly short and mid grasses. Low rainfall limits production to moderate yields during favorable years. Tarbush and mesquite dominate in some areas.

The soils of this association have a medium potential for most urban uses. Shrinking and swelling with changes in moisture, low strength, corrosivity to uncoated steel, and seepage when used for sewage lagoons are the main limiting features. Potential for recreational uses is medium because the surface layer is too clayey and dusty. Slope restricts some playground uses.

2. Angelo-Rioconcho Association

Deep, nearly level and gently sloping, calcareous, loamy and clayey soils on uplands and bottom lands

This association is made up mainly of nearly level to gently sloping soils. Slopes are 0 to 3 percent. The association makes up about 20 percent of the county. Angelo soils make up about 66 percent of the association; Rioconcho soils, about 11 percent; and less extensive areas of Broome, Ector, Lipan, Reagan, and Tobosa soils, the remaining 23 percent.

Angelo soils are on broad, nearly level to gently sloping uplands. These soils have a surface layer about 16 inches thick. The upper 8 inches is friable, moderately alkaline, dark brown silty clay loam. The lower 8 inches is firm, moderately alkaline, reddish brown silty clay. Between the depths of 16 and 34 inches, the soil is firm, moderately alkaline, reddish brown silty clay. The next layer extends to a depth of 80 inches or more. The upper 13 inches is friable, moderately alkaline, pink silty clay. It is about 25 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate. The lower 33 inches is friable, moderately alkaline, reddish yellow silty clay and is about 15 percent, by volume, calcium carbonate.

Rioconcho soils are on nearly level bottom lands. These soils have a surface layer of friable, moderately alkaline, very dark grayish brown silty clay about 16 inches thick. The next layer is very firm, moderately alkaline, dark brown silty clay about 26 inches thick. The next 20 inches is moderately alkaline, brown silty clay. In the upper part, this layer is very firm and contains about 5 percent, by volume, calcium carbonate concretions, and in the lower part it is firm and contains no concretions. From 62 to 80 inches or more, the soil is friable, moderately alkaline, brown silty clay loam.

The deep, loamy Broome soils are on gently sloping, convex side slopes along draws and around playas. The shallow or very shallow, loamy Ector soils are on gently sloping to steep limestone plateaus. The deep, clayey Lipan soils are on nearly level bottoms of depressions or playas. The deep, loamy Reagan soils are nearly level to gently sloping in valleys or on alluvial fans. The deep, clayey Tobosa soils are nearly level in valleys or on tops of low mesas.

The soils of this association are used mainly for range, but some areas are cultivated.

Potential for growing cultivated crops is high. Low rainfall and lack of irrigation water limit the acreage of this association used for cultivation. When the soil is cultivated, cotton and grain sorghum are the main crops.

Potential for range is medium. Low rainfall limits production to moderate yields during favorable years. Native range plants are mainly short and mid grasses on the uplands and tall grasses on the bottom lands.

Potential for most urban uses is low. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, low strength, slow percolation, and flooding are the most limiting features. Potential for recreational uses is medium mainly because of slope, slow percolation, flooding, and clay content of the surface layer.

3. Conger Association

Shallow, gently sloping, calcareous, loamy soils on uplands

This association is made up mainly of gently sloping soils. Slopes are 1 to 5 percent. The association makes up about 16 percent of the county. Conger soils make up about 75 percent of the association, and less extensive areas of Bippus, Blakeney, Ector, Mereta, and Reagan soils make up the remaining 25 percent.

Conger soils are on ridges, divides, and foot slopes. They have a surface layer of friable, moderately alkaline, brown clay loam about 5 inches thick. Between the depths of 5 and 18 inches, the soil is friable, moderately alkaline, pale brown clay loam. It has an abrupt boundary and is underlain at a depth of 18 inches by a layer of whitish indurated caliche about 17 inches thick. Between the depths of 35 and 60 inches the soil is pinkish white, weakly cemented caliche that has texture similar to clay loam.

The deep, loamy Bippus soils are on the nearly level bottoms of drainageways and outwash fans. The shallow, loamy Blakeney soils are on gently sloping ridges, divides, and foot slopes. The shallow or very shallow, loamy Ector soils are on gently sloping to steep limestone plateaus. The shallow, loamy Mereta soils are on gently sloping outwash plains. The deep, loamy Reagan soils are nearly level to gently sloping in valleys or on alluvial fans.

The soils of this association are used almost entirely for range. In a few areas, the underlying caliche is mined and used as a source of fill material in road construction.

Potential for cultivated crops is low. Slope, shallow depth to indurated caliche, and the hazard of water erosion or soil blowing restrict use of the soils mainly to range. A few small areas of the less extensive soils can be cultivated. Cotton and grain sorghum are the main cultivated crops.

Potential for range is also low. Low rainfall, low available water capacity, and shallow rooting depth limit the amount of forage that can be grown during favorable years. Native range plants are mainly short and mid grasses.

Potential for most urban uses is low. Shallow depth to indurated caliche is the most limiting feature. Potential for recreational uses is medium mainly because of slope and the dusty surface layer.

4. Amarillo-Midessa Association

Deep, nearly level and gently sloping, noncalcareous and calcareous, loamy soils on uplands

This association is made up mainly of nearly level to gently sloping soils. Slopes are 0 to 5 percent. The association makes up about 13 percent of the county. Amarillo soils make up about 40 percent of the associa-

tion; Midessa soils, about 36 percent; and less extensive areas of Acuff, Arvana, Bippus, Estacado, Lipan, Patricia, Potter, and Reagan soils, the remaining 24 percent (fig. 2).

Amarillo soils, which have slopes of 0 to 3 percent, are on nearly level to gently sloping uplands. They have a surface layer of friable, neutral, brown fine sandy loam about 8 inches thick. Between the depths of 8 and 34 inches, the soil is friable, mildly alkaline sandy clay loam. It is reddish brown in the upper 10 inches and yellowish red in the lower 16 inches. The next layer is friable, moderately alkaline, reddish yellow sandy clay loam about 18 inches thick. The next lower layer is friable, moderately alkaline, pink sandy clay loam about 12 inches thick. It contains about 30 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate. Between the depths of 64 and 80 inches, the soil is friable, moderately alkaline, reddish yellow sandy clay loam and is about 20 percent, by volume, calcium carbonate.

Midessa soils, which have slopes of 0 to 5 percent, are on nearly level to gently sloping uplands. These soils have a surface layer of very friable, moderately alkaline, brown fine sandy loam about 9 inches thick. The next layer is very friable, moderately alkaline sandy clay loam about 25 inches thick. It is brown in the upper 10 inches and light brown in the lower 15 inches. The next layer is friable, moderately alkaline, pink clay loam about 24 inches thick. It contains about 45 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate. Between the depths of 58 and 80 inches, the soil is friable, moderately alkaline, light reddish brown clay loam and contains about 25 percent, by volume, calcium carbonate.

The deep, loamy Acuff soils and Estacado soils are on nearly level uplands. The moderately deep, loamy Arvana soils are on gently sloping upland plains. The deep, loamy Bippus soils are on nearly level bottoms of drainageways and outwash fans. The deep, clayey Lipan soils are on nearly level bottoms of depressions or shallow playas. The deep, sandy Patricia soils are on nearly level to gently sloping upland plains. The very shallow, loamy Potter soils are on gently sloping to sloping, broad, convex ridges. The deep, loamy Reagan soils are nearly level to gently sloping in valleys or on alluvial fans.

The soils of this association are used for range and cultivated crops.

Potential for growing cultivated crops is high. Low rainfall and lack of irrigation water limit the acreage of this association used for cultivation. When the soil is cultivated, cotton and grain sorghum are the main crops.

Potential for range is high. Yields of short and mid grasses are good during favorable years.

Potential for most urban uses is high. Slope, seepage, low strength, and corrosivity to uncoated steel are the most limiting features, but they are easily overcome with good design and installation procedures. Potential for recreational uses is high. Slope limits some playground uses.

5. Ector Association

Very shallow and shallow, gently sloping to steep, calcareous, loamy soils on uplands

This association is made up mainly of gently sloping to steep soils. Slopes are 1 to 40 percent, but they average about 12 percent. The association makes up about 10 percent of the county. Ector soils make up about 73 percent of the association, and less extensive areas of Angelo, Conger, Mereta, and Rioconcho soils make up the remaining 27 percent (fig. 3).

Ector soils are on limestone plateaus, plains, and erosional landscapes. They have a surface layer of friable, moderately alkaline, dark brown gravelly clay loam about 9 inches thick. This layer is about 50 percent, by volume, limestone fragments. The surface layer has an abrupt boundary that is underlain by fractured limestone bedrock that extends to depths greater than 40 inches.

The deep, loamy Angelo soils are on nearly level to gently sloping uplands in the association. The shallow, loamy Conger and Mereta soils are on ridges, foot slopes, and outwash plains. The Rioconcho soils are deep and clayey and are on flood plains of streams and drainageways.

The soils of this association are used almost entirely for range. In a few areas, the limestone bedrock underlying the soils is mined for roadbed material.

Potential for cultivated crops is low. Steep slopes, shallow or very shallow rooting depth, and hazard of water erosion restrict use of the soils mainly to range. A few small areas of the less extensive soils can be cultivated. Cotton and grain sorghum are the main cultivated crops.

Potential for range is also low. Low rainfall, very low available water capacity, and restricted rooting depth limit the amount of forage that can be produced during favorable years. Native range plants are mainly short and mid grasses. Some areas have been invaded by juniper.

Potential for most urban uses is low. Slope, shallow or very shallow depth to limestone bedrock, and corrosivity to uncoated steel are the most limiting features. Potential for recreation uses is medium. Slope and small stones on the surface restrict use of the soils for camp areas, picnic areas, playgrounds, paths, and trails.

6. Patricia-Pyote Association

Deep, nearly level and gently sloping, noncalcareous, sandy soils on uplands

This association is made up mainly of nearly level to gently sloping soils. Slopes are 0 to 5 percent. The association makes up about 5 percent of the county. Patricia soils make up about 46 percent of the association; Pyote soils, about 28 percent; and less extensive areas of Amarillo, Potter, and Springer soils, the remaining 26 percent (fig. 4).

Patricia soils, which have slopes of 0 to 3 percent, are on nearly level to gently sloping upland plains. These soils have a surface layer of friable, neutral, reddish brown

loamy fine sand about 14 inches thick. The next 32 inches consists of friable, neutral, red sandy clay loam. Between the depths of 46 and 80 inches, the soil is friable, mildly alkaline sandy clay loam. This layer is yellowish red in the upper 18 inches and reddish yellow in the lower 16 inches.

Pyote soils, which have slopes of 0 to 5 percent, are on nearly level to gently sloping uplands. These soils have a surface layer of loose, slightly acid fine sand about 26 inches thick. This layer is brown in the upper 6 inches and light brown in the lower 20 inches. The next layer is very friable, slightly acid, reddish yellow loamy fine sand about 20 inches thick. The next lower layer, to a depth of about 60 inches, is very friable, neutral, reddish yellow loamy fine sand. Between the depths of 60 to 80 inches, the soil is loose, strongly acid, reddish yellow fine sand.

The deep, loamy Amarillo soils are on nearly level to gently sloping uplands. The very shallow, loamy Potter soils are on gently sloping to sloping, broad, convex ridges. The deep, sandy Springer soils are on nearly level to gently sloping uplands.

The soils of this association are used mainly for range. A few areas of the Patricia soils are cultivated, but the Pyote soils are not suitable for cultivation.

Potential for growing cultivated crops is medium. Low rainfall and the soil blowing hazard are the most restrictive factors. Cotton and grain sorghum are the main crops.

Potential for range is high. Native range plants are mainly tall grasses. Yields of forage are good during favorable years.

The soils of this association have a high potential for most urban uses. When soils are used for reservoirs or sewage lagoons, seepage and low strength are the most limiting factors. Potential for recreational uses is medium mainly because of slope and the sandy surface layer.

Land Use Consideration

The soil associations in Glasscock County vary widely in their potential for major land uses, as is indicated in table 1. For each land use, the potential of each soil association is rated in relation to the other soil associations. Soil limitations are also indicated in general terms. The ratings of soil potential reflect the relative cost of management practices and also the hazard of continuing soil related problems after such practices are installed. The ratings do not consider location in relation to existing transportation systems or other kinds of facilities.

Kinds of land uses include cultivated crops, specialty crops, range, urban use, and recreation. Cultivated farm crops grown in the survey area include cotton, grain sorghum, and wheat. Specialty crops include vegetables and nursery crops, which are grown on limited acreage and generally require intensive management. Range refers to land in native range plants. Urban uses include land used for residential, commercial, and industrial sites. Recreation includes nature study trails, wilderness, picnic and camp areas, and playgrounds.

In general, the kinds of soils, low rainfall, and lack of irrigation water are the most important factors that influence land use in Glasscock County.

Presently, about 88 percent of the county is used for range, and about 9 percent is used for cultivated farm crops. However, it is indicated in table 1 that about 18 percent of the county has a high potential for range, about 56 percent has a medium potential for range, and about 26 percent has a low potential for range. It is also indicated in table 1 that about 69 percent of the county has a high potential, about 5 percent has a medium potential, and about 26 percent has a low potential for cultivated farm crops. This means that about 60 percent of the county could be converted from range to cultivated farmland if water were available.

The trend in recent years has been a slight decrease in the number of acres used for range and a slight increase in the number of acres used for crops, generally as irrigation water supplies are developed.

There has also been a slight increase in the number of acres used for specialty crops, urban development, and recreational uses.

In general, the Reagan, Angelo-Rioconcho, and Amarillo-Midessa associations have a high potential for cultivated farm crops and specialty crops. The soils in these associations are deep, loamy or clayey, and are well suited to cultivation. However, they require good management practices to prevent water erosion and soil blowing. The Amarillo-Midessa association and the Patricia-Pyote association have a high potential for range and urban uses. These deep, loamy or sandy soils also require careful management to prevent water erosion and soil blowing. In addition, they require good design and installation procedures when used for urban structures. The main problems are seepage and low strength. The Amarillo-Midessa association is the only association that has a high potential for recreational uses. The more sloping areas of this association limit some playground uses. The shallow or very shallow, loamy soils of the Conger association and the Ector association have a low potential for most uses. Slope, water erosion hazard, soil blowing hazard, small stones on the surface, and depth to indurated caliche or limestone bedrock are the most limiting features.

The general soil information in this section and the more detailed information in following sections can be used as a guide in planning orderly growth and development of the county. This information is especially helpful in determining which lands to allocate to each use.

Soil Maps for Detailed Planning

The kinds of soil (mapping units) shown on the detailed soil maps at the back of this publication are described in this section. These descriptions together with the soil maps can be useful in determining the potential of soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in

enhancing, protecting, and preserving the environment. More detailed information for each soil is given in the section "Planning the Use and Management of the Soils."

Preceding the name of each mapping unit is the symbol that identifies the unit on the detailed soil map. Each mapping unit description includes general facts about the soil and a brief description of the soil profile. The potential of the soil for various major land uses is estimated. The principal hazards and limitations are indicated, and the management concerns and practices for the major uses are discussed.

A mapping unit represents an area on the landscape and consists of a dominant soil or soils for which the unit is named. Most mapping units have one dominant soil, but some have two or more dominant soils. A mapping unit commonly includes small, scattered areas of other soils. The properties of some included soils can differ substantially from those of the dominant soil or soils and thus greatly influence the use of the dominant soil. How the included soils may affect the use and management of the mapping unit is discussed.

Two mapping units in this county are made up of soils in different phases of a single series. Such mapping units are called soil associations. A soil association is made up of adjacent soils in areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and extent of the dominant soils, but the soils may differ greatly one from another.

The acreage and proportionate extent of each mapping unit are given in table 2, and additional information on each unit is given in interpretive tables in other sections (see "Summary of Tables"). Many of the terms used in describing soils are defined in the Glossary.

Soil Descriptions and Potentials

CHARLES HAENISCH, conservation agronomist, Soil Conservation Service, assisted in writing this section.

The 29 kinds of soil (mapping units) in Glasscock County are described in the following paragraphs.

AcA—Acuff loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Slopes average about 0.7 percent. Areas are irregular in shape and range from 10 to 200 acres in size.

This soil has a surface layer of friable, neutral, brown loam about 8 inches thick. The next layer is about 15 inches of friable, mildly alkaline, reddish brown sandy clay loam. The next layer, extending from 23 to 45 inches, is friable, moderately alkaline, yellowish red sandy clay loam. Between the depths of 45 and 80 inches, the soil is friable, moderately alkaline, reddish yellow sandy clay loam. It is about 43 percent, by volume, calcium carbonate in the upper 21 inches and about 20 percent calcium carbonate in the lower 14 inches.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. This soil has good tilth and can be worked during a wide range of moisture conditions. The rooting zone is deep and is easily penetrated by plant roots. The water erosion and soil blowing hazards are slight.

Included with this soil in mapping are small areas of Amarillo, Estacado, and Midessa soils. Also included are small areas of Acuff soils that have slopes of 1 to 3 percent. Included soils make up less than 15 percent of any one mapped area.

This soil is used for crops and range. Cotton is the main crop, but other crops can be grown.

This soil has a high potential for growing nonirrigated and irrigated cotton, grain sorghum, and wheat. Good management includes leaving residue on the surface when crops are not being grown, timely and limited tillage, and rotation of crops. These practices help to control soil blowing and water erosion and help to conserve moisture. Residue also helps to maintain soil productivity. Emergency tillage operations are occasionally necessary to roughen the soil surface. These operations help to reduce damage from soil blowing if crop growth and residue produce inadequate cover. A well-designed irrigation system and proper application of irrigation water are essential where this soil is irrigated. Both surface or sprinkler irrigation systems can be used. When this soil is irrigated, fertilizer is needed.

This soil has a medium potential for growing native range plants. Its potential is limited because of low available plant moisture during the growing season. Native range plants are mainly short grasses that produce a medium amount of forage. Potential for wildlife habitat is medium.

This soil has a high potential for most urban and recreational uses. It is corrosive to uncoated steel and has low strength. These limitations can be easily overcome by good design and careful installation procedures. Potential for recreational uses is high. Capability subclass IIIe nonirrigated, IIe irrigated; Clay Loam range site.

AmA—Amarillo fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Slopes average about 0.7 percent. Areas are irregular in shape and range from 10 to 500 acres in size.

The surface layer is friable, neutral, brown fine sandy loam about 9 inches thick. The next layer is friable, mildly alkaline sandy clay loam about 45 inches thick. It is reddish brown in the upper 20 inches and yellowish red in the lower 25 inches. Between the depths of 54 and 80 inches, the soil is friable, moderately alkaline sandy clay loam. It is pink in the upper 14 inches and reddish yellow in the lower 12 inches. This layer is about 30 to 40 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is medium. The rooting zone is deep and easily penetrated by plant roots. The water erosion hazard is slight, and the soil blowing hazard is moderate.

Included with this soil in mapping are small areas of Acuff, Lipan, and Midessa soils. Also included are small areas of Amarillo soils with 1 to 3 percent slopes. Around the bases of mesquite trees in undisturbed areas are small sandy mounds 6 to 12 inches higher than the surrounding soils. Inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland and range. Cotton is the main crop, but other crops can be grown.

Potential for growing nonirrigated and irrigated cotton, grain sorghum, or wheat is high. Keeping crop residue on or near the soil surface conserves moisture and helps to control soil blowing and water erosion. Diversion terraces and grassed waterways can be used to control outside runoff. In dry years, emergency tillage is needed to control soil blowing if crop residue does not furnish adequate protection. A properly designed irrigation system and proper application of irrigation water are necessary. Either a surface irrigation system or a sprinkler irrigation system can be used. Fertilizer is needed when this soil is irrigated.

Potential for growing native range plants is high. Yields of short and mid grasses are good during favorable years. Potential for wildlife habitat is medium.

This soil has a high potential for most urban uses. Low strength for streets and roads and seepage problems when the soil is used for sewage lagoons are the most restrictive features. Potential for recreational uses is high. Capability subclass IIIe nonirrigated, IIe irrigated; Sandy Loam range site.

AmB—Amarillo fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. Slopes are slightly convex and average about 2 percent. Areas are irregular in shape and range from 20 to 700 acres in size.

This soil has a surface layer of friable, neutral, brown fine sandy loam about 8 inches thick (fig. 5). Between the depths of 8 and 34 inches, the soil is friable, mildly alkaline sandy clay loam. It is reddish brown in the upper 10 inches and yellowish red in the lower 16 inches. The next layer is friable, moderately alkaline, reddish yellow sandy clay loam about 18 inches thick. The next lower layer is about 12 inches of friable, moderately alkaline, pink sandy clay loam and is about 30 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate. Between the depths of 64 and 80 inches, the soil is friable, moderately alkaline, reddish yellow sandy clay loam and contains about 20 percent, by volume, calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The rooting zone is deep and easily penetrated by plant roots. The water erosion and soil blowing hazards are moderate.

Included with this soil in mapping are small areas of Arvana soils and Midessa soils. Also included is a soil similar to Amarillo fine sandy loam, except that the layer of calcium carbonate is below a depth of 60 inches. In undisturbed areas, sandy mounds 6 to 12 inches high have accumulated around the bases of mesquite trees. Inclusions comprise less than 30 percent of any one mapped area.

This soil is used mainly as range, but cultivated crops can be grown. Cotton and grain sorghum are the main cultivated crops.

Potential for growing nonirrigated and irrigated cotton and grain sorghum is high. Crop residue needs to be kept on or near the soil surface to help control water erosion and soil blowing and conserve moisture. Contour farming and terraces are needed to help control water erosion. Grassed waterways make good outlets for a terrace system. In dry years, emergency tillage is needed to control soil blowing where crop residue does not furnish adequate protection. Where this soil is irrigated, a properly designed irrigation system and proper application of irrigation water are essential. A sprinkler irrigation system is best adapted. If a surface system is used, bench leveling is necessary. Fertilizer is needed when this soil is irrigated.

Potential for growing native range plants is high. Low rainfall is the most limiting factor. Potential for wildlife habitat is medium.

This soil has a high potential for most urban uses. Low strength and seepage are the most restrictive features. Potential for recreational uses is high. Slope restricts some playground uses. Capability subclass IIIe nonirrigated, IIIe irrigated; Sandy Loam range site.

AnA—Angelo silty clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Slopes average about 0.7 percent. Areas are irregular in shape and range from 20 to several hundred acres in size.

The surface layer is about 16 inches thick (fig. 6). The upper 8 inches is friable, moderately alkaline, dark brown silty clay loam. The lower 8 inches is firm, moderately alkaline, reddish brown silty clay. Between the depths of 16 and 34 inches, the soil is firm, moderately alkaline, reddish brown silty clay. The next layer extends from 34 inches to 80 inches. The upper 13 inches is friable, moderately alkaline, pink silty clay and is about 25 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate. The lower 33 inches is friable, moderately alkaline, reddish yellow silty clay and is about 15 percent calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderately slow. Available water capacity is high. The rooting zone is deep, but silty clay lower layers tend to impede the movement of air, water, and roots. The water erosion and soil blowing hazards are slight.

Included with this soil in mapping are small areas of Conger, Lipan, Reagan, and Rioconcho soils. Also included are small areas of Angelo soils that have slopes of 1 to 3 percent. Inclusions make up less than 15 percent of any one mapped area.

This soil is used mainly as range, but a few areas are cultivated. Cotton and grain sorghum are the main crops.

Potential for growing nonirrigated and irrigated cotton and grain sorghum is high. Keeping crop residue on or near the soil surface helps conserve moisture. Residue also helps protect the soil from water erosion and soil blowing. A properly designed irrigation system and proper application of irrigation water are essential. A surface or sprinkler system can be used. Fertilizer is necessary when this soil is irrigated.

Potential for growing native range plants in medium. Low rainfall produces only moderate yields of short and mid grasses even during favorable years. Potential for wildlife habitat is also medium.

Potential for most urban uses is low. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, low strength, and slow percolation rate are the most restrictive features. Potential for recreational uses is medium mainly because of the silty clay loam surface layer and the slow percolation rate. Capability subclass IIIc nonirrigated, capability class I irrigated; Clay Loam range site.

AnB—Angelo silty clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands, mainly along natural drainageways. Slopes average about 2 percent. Areas are irregular to oblong in shape and range from 15 to 200 acres in size.

This soil has a surface layer about 14 inches thick. The upper 6 inches is friable, moderately alkaline, dark grayish brown silty clay loam. The lower 8 inches is firm, moderately alkaline, brown silty clay. The next layer is friable, moderately alkaline silty clay about 18 inches thick. It is brown in the upper part and reddish brown in the lower part. Between the depths of 32 and 78 inches, the soil is friable, moderately alkaline silty clay and is about 30 percent, by volume, calcium carbonate. This layer is pink in the upper 12 inches and reddish yellow in the lower 34 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderately slow. Available water capacity is high. The rooting zone is deep, but silty clay lower layers tend to impede the movement of air, water, and roots. The water erosion hazard is moderate, and the soil blowing hazard is slight.

Included with this soil in mapping are small areas of Conger, Reagan, and Rioconcho soils. Also included are small areas of Angelo soils that have slopes of 0 to 1 percent. Inclusions make up less than 20 percent of any one mapped area.

This soil is used almost entirely as range, but can be cultivated. Cotton and grain sorghum are the main cultivated crops.

Potential for growing nonirrigated and irrigated cotton and grain sorghum is high. Crop residue needs to be left on or near the soil surface. Residue helps to control water erosion, to protect the soil from blowing, and to conserve moisture. Contour farming and terraces are needed to control runoff. Grassed waterways provide good outlets for terrace systems. A properly designed irrigation system and proper application of irrigation water are essential. A sprinkler system is best adapted. If a surface system is used, bench leveling is necessary. Fertilizer is needed when this soil is irrigated.

Potential for growing native range plants is medium. Low rainfall and medium runoff limit this soil to moderate yields of short and mid grasses during favorable years. Potential for wildlife habitat is medium.

This soil has a low potential for most urban uses. Corrosivity to uncoated steel, low strength, shrinking and swelling with changes in moisture, and slow percolation rate are the most restrictive features. Potential for recreational uses is medium. The most restrictive features for recreation are slope, a silty clay loam surface layer, and slow percolation rate. Capability subclass IIIe nonirrigated, IIe irrigated; Clay Loam range site.

ArB—Arvana fine sandy loam, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on upland plains. Slopes average about 2 percent. Areas are irregular in shape and range from 15 to 100 acres in size.

This soil has a surface layer of very friable, neutral, brown fine sandy loam about 9 inches thick. The next layer is friable, neutral, reddish brown sandy clay loam about 11 inches thick. Between the depths of 20 and 28 inches, the soil is friable, mildly alkaline, red sandy clay loam. This layer has an abrupt boundary and is underlain by a layer of pinkish white indurated caliche about 12 inches thick. Between the depths of 40 and 70 inches, the soil is friable, moderately alkaline, pinkish white loam and is about 70 percent calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The rooting zone is moderately deep. The water erosion and soil blowing hazards are moderate.

Included with this soil in mapping are small areas of Amarillo soils. Also included are small areas of a soil similar to Arvana fine sandy loam, except that it is less than 20 inches to indurated caliche. Inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland and range. Cotton and grain sorghum are the main cultivated crops.

Potential for growing nonirrigated and irrigated cotton or grain sorghum is medium. Keeping crop residue on or near the soil surface helps conserve moisture and control water erosion and soil blowing. Contour farming, terraces, and grassed waterways are needed to help control excess runoff. When cuts or excavations exceed a depth of 20 inches, there is a hazard of cutting into a layer of indurated caliche. In dry years, emergency tillage is needed to control soil blowing if crop residue does not furnish adequate protection. A well-designed irrigation system and proper application of irrigation water are necessary. A sprinkler irrigation system is best adapted. If a surface irrigation system is used, bench leveling is necessary. Fertilizer is needed when this soil is irrigated.

Potential for growing native range plants is high. During favorable years, this soil produces good yields of short and mid grasses. Potential for wildlife habitat is medium.

This soil has a low potential for most urban uses. Depth to indurated caliche is the most restrictive feature. Potential for most recreational uses is high. Slope restricts some playground uses. Capability subclass IIIe nonirrigated, IIIe irrigated; Sandy Loam range site.

BcA—Bippus clay loam, 0 to 1 percent slopes. This deep, nearly level soil is in drainageways and on adjacent outwash fans. It occasionally receives runoff from adjacent slopes of upland soils. Slopes average about 0.5 percent. Areas are long and narrow. They extend for several miles.

The surface layer is friable, moderately alkaline clay loam about 24 inches thick. It is dark grayish brown in the upper 12 inches and dark brown in the lower 12 inches. Buried soil layers occur below 24 inches. Between the depths of 24 and 56 inches, the soil is friable, moderately alkaline, brown clay loam and contains about 2 percent, by volume, calcium carbonate. Between the depths of 56 and 62 inches, the soil is friable, moderately alkaline, light brown clay loam.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The rooting zone is deep and easily penetrated by plant roots. The water erosion and soil blowing hazards are slight.

Included with this soil in mapping are small areas of Rioconcho soils. Also included are a few areas of a soil similar to Bippus clay loam, except that the surface layer is sandier. A few saline spots, which are characterized by alkaline sacaton vegetation, are included. Inclusions comprise less than 10 percent of any one mapped area.

This soil is used almost entirely as range. It can be cultivated, however, if areas are large enough and are protected from excess runoff. Cotton, grain sorghum, and wheat can be grown.

Potential for growing nonirrigated and irrigated cotton, grain sorghum, or wheat is high. Keeping crop residue on or near the soil surface conserves moisture and helps to prevent water erosion and soil blowing. Diversion terraces and grassed waterways help to control excess runoff water from adjacent slopes. A well-designed irrigation system and proper application of irrigation water are essential. Both surface and sprinkler irrigation systems can be used. Irrigated crops need to be fertilized.

Potential for growing native range plants is high. Runoff from adjacent slopes helps to produce good yields of forage during favorable years. This soil also has a high potential for wildlife habitat.

Potential for urban uses is low. Possibility of flooding, shrinking and swelling with changes in moisture, and corrosivity to uncoated steel are the most restrictive features. Potential for recreational uses is also low mainly because of flooding and the clay loam surface layer. Capability subclass IIw nonirrigated, IIw irrigated; Draw range site.

BfB—Blakeney fine sandy loam, 1 to 3 percent slopes. This shallow, gently sloping soil is on uplands, mainly on ridges, divides, and foot slopes. Slopes average 2.5 percent. Areas are irregular in shape and range from 10 to 93 acres in size.

This soil has a surface layer of friable, moderately alkaline, brown fine sandy loam about 5 inches thick. Between the depths of 5 and 13 inches, the soil is friable, moderately alkaline, light brown fine sandy loam and is about 2 percent, by volume, calcium carbonate concretions. At a depth of 13 inches, the soil is underlain by whitish indurated caliche that extends to a depth of about 35 inches. Between the depths of 35 and 60 inches, the soil is pinkish white, weakly cemented caliche that has texture of clay loam.

This soil is well drained. Surface runoff is medium. Permeability is moderately rapid, and available water capacity is low. The rooting zone is shallow. The water erosion and soil blowing hazards are moderate.

Included with this soil in mapping are small areas of Conger, Midessa, and Reagan soils. Included soils make up less than 15 percent of any one mapped area.

This soil is not suitable for cultivation. Shallow depth to indurated caliche and susceptibility to water erosion and soil blowing restrict use of the soil to range. In a few areas, the layers of caliche underlying this soil are mined and used as sources of fill material in road construction. This soil has a low potential for growing native range plants mainly because of low rainfall, low available water capacity, and shallow rooting depth. Potential for wildlife habitat is medium if the site is close to grain and seed crops.

This soil has a low potential for most urban uses. The most limiting feature is shallow depth to indurated caliche. Potential for recreational uses is medium mainly because the soil is dusty. Capability subclass VIe nonirrigated; Shallow range site.

BrB—Broome clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands, mainly on the sides of valleys and draws and around playas. Slopes average about 2 percent. Areas are irregular to elongated in shape and range from 10 to 100 acres in size.

The surface layer of this soil is friable, moderately alkaline, brown clay loam about 7 inches thick. The next layer is friable, moderately alkaline, reddish brown clay loam about 12 inches thick, and it is about 16 percent, by volume, calcium carbonate concretions. Between the depths of 19 and 36 inches, the soil is friable, moderately alkaline, light reddish brown clay loam and is about 29 percent, by volume, calcium carbonate concretions (fig. 7). Between the depths of 36 and 70 inches, the soil is firm, moderately alkaline, reddish yellow clay loam and is about 28 percent, by volume, calcium carbonate concretions.

This soil is well drained. Surface runoff is medium. Permeability is moderate. Available water capacity is medium. The rooting zone is deep and easily penetrated by plant roots. The water erosion hazard is moderate, and the soil blowing hazard is slight.

Included with this soil in mapping are small areas of Angelo, Conger, and Rioconcho soils. Inclusions make up less than 15 percent of any one mapped area.

This soil is used mainly for range, but a few small areas are cultivated. Cotton, grain sorghum, and wheat may be grown.

Potential for growing nonirrigated and irrigated cotton, grain sorghum, or wheat is medium. Keeping crop residue on or near the soil surface helps conserve moisture and prevent water erosion and soil blowing. Contour farming, terraces, and grassed waterways help to control water erosion from excess runoff. When cuts or excavations exceed 6 inches, there is a hazard of cutting into soil material that contains concentrations of calcium carbonate. If the soil is irrigated, a well-designed irrigation system and proper application of irrigation water are essential. Both surface and sprinkler irrigation systems can be used. Fertilizer is needed for adequate yields.

Potential for growing native range plants is medium. Potential for wildlife habitat is also medium.

This soil has a medium potential for most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and low strength are the most restrictive factors. Good design and installation procedures are needed. Potential for recreational uses is medium. The dusty clay loam surface layer is the most restrictive feature. Capability subclass IIIe nonirrigated, and IIe irrigated; Loamy range site.

CnC—Conger clay loam, 1 to 5 percent slopes. This shallow, gently sloping soil is on uplands, mainly on ridges, divides, and side slopes around playas. Slopes average about 3 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

This soil has a surface layer of friable, moderately alkaline, brown clay loam about 5 inches thick. Between the depths of 5 and 18 inches, the soil is friable, moderately alkaline, pale brown clay loam. It has an abrupt boundary and is underlain by a layer of whitish indurated caliche (fig. 8). This layer is about 17 inches thick. Between the depths of 35 and 60 inches, the soil is pinkish white, weakly cemented caliche that has texture similar to clay loam.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is low. The rooting zone is shallow. The water erosion and soil blowing hazards are moderate.

Included with this soil in mapping are small areas of Blakeney, Ector, and Reagan soils. Included soils make up less than 15 percent of any one mapped area.

This soil is not suitable for cultivation. Slope, shallow depth to indurated caliche, and susceptibility to water erosion and soil blowing restrict use of the soil to range. In a few areas, the layers of caliche underlying this soil are mined and used as sources of fill material in road construction.

Potential for growing native range plants is low. Low rainfall, low available water capacity, and shallow rooting depth limit the amount of forage grown. Potential for wildlife habitat is medium in areas close to grain and seed crops.

This soil has a low potential for most urban uses. Shallow depth to indurated caliche is the most limiting feature. Potential for recreational uses is medium mainly because the soil is dusty. Capability subclass VIe nonirrigated; Shallow range site.

COD—Cottonwood association, undulating. The soils in this association consist of very shallow, undulating soils on uplands. Slopes range from 1 to 8 percent but average about 3 percent. Areas are oblong to irregular in shape and range from 15 to 176 acres in size.

The composition of this association is more variable than that of other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated use of the soils.

The Cottonwood soils in this association have a surface layer of friable, moderately alkaline loam about 7 inches thick. This layer is grayish brown in the upper 3 inches and light brownish gray in the lower 4 inches. It has an abrupt boundary and is underlain by a layer of white, soft chalky gypsum that extends to a depth greater than 20 inches.

The soils in this association are well drained. Surface runoff is rapid. Permeability is moderate, and available water capacity is very slow. The water erosion and soil blowing hazards are moderate.

Included with these soils in mapping are small areas of Monahans soils and areas of gypsum material covered with less than 3 inches of soil. In a few areas, the soil is more than 12 inches thick over gypsum. Also included are a few U-shaped gullies that are 10 to 25 inches wide and 6 to 15 inches deep. Inclusions make up less than 30 percent of any one mapped area.

These soils are not suitable for cultivation because of slope, very shallow rooting depth, and susceptibility to water erosion. They are used mainly for range, but potential for growing native range plants is low. Low rainfall, rapid runoff, very low available water capacity, and restricted rooting depth limit the amount of forage produced. Potential for wildlife habitat is also low.

The soils in this association have a low potential for most urban uses. Slope, depth to gypsum, seepage, and corrosivity to uncoated steel and concrete are the most limiting features. Potential for recreational uses is medium because the soils are too sloping and have a dusty surface layer. Capability subclass VIIs nonirrigated; Gyp range site.

ECD—Ector association, undulating. This association consists of shallow or very shallow, gently undulating to steep, soils on uplands. It is on limestone plateaus, plains, and erosional landscapes. Slopes range from 1 to 40 percent but average about 12 percent. About 17 percent of the surface area is covered with limestone rocks. Areas are irregular in shape and range from 25 acres to several hundred acres in size.

The composition of this association is more variable than that of other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated use of the soils.

The Ector soils in this association have a surface layer of friable, moderately alkaline, dark brown gravelly clay loam about 9 inches thick (fig. 9). Limestone fragments make up about 50 percent, by volume, of the surface layer. This layer has an abrupt boundary and is underlain by fractured limestone bedrock that extends to depths greater than 40 inches.

The soils in this association are well drained. Surface runoff is rapid. Permeability is moderate, and available water capacity is very low. The rooting zone is shallow or very shallow. The water erosion hazard is moderate. The soil blowing hazard is slight.

Included with these soils in mapping are small areas of Angelo, Broome, Conger, and Reagan soils. Also included are outcrops of limestone bedrock on ridgetops and along benched areas on the side slopes of ridges. Inclusions make up less than 25 percent of any one mapped area.

The soils in this association are not suitable for cultivation because of slope, shallow or very shallow rooting depth, and susceptibility to water erosion. These soils are used mainly for range (fig. 10), but potential for growing native range plants is low. Low rainfall, rapid runoff, very low available water capacity, and restricted rooting depth limit the amount of forage produced. Potential for wildlife habitat is also low.

The soils in this association have a low potential for most urban uses and medium potential for most recreational uses. Slope, small stones on the surface, shallow or very shallow depth to bedrock, and corrosivity to uncoated steel are the most limiting features. Capability subclass VIIs nonirrigated; Limestone Hill range site.

EsA—Estacado clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on upland plains. Slopes average about 0.6 percent. Areas are irregular in shape and range from 10 to 70 acres in size.

This soil has a surface layer of friable, moderately alkaline, brown clay loam about 16 inches thick. The next layer, from 16 to 36 inches, is friable, moderately alkaline clay loam and has a few concretions of calcium carbonate. It is brown in the upper 9 inches and light brown in the lower 11 inches. Between the depths of 36 and 60 inches the soil is friable, moderately alkaline, pink clay loam and is about 45 percent, by volume, calcium carbonate. Between the depths of 60 and 80 inches, the soil is friable, moderately alkaline, reddish yellow clay loam and is about 30 percent, by volume, calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. This soil has good tilth. The rooting zone is easily penetrated by plant roots. The water erosion hazard is slight, and the soil blowing hazard is moderate.

Included with this soil in mapping are small areas of Acuff, Amarillo, and Midessa soils. Inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland and range. Cotton is the main crop, but other crops can be grown.

This soil has a high potential for growing nonirrigated cotton, grain sorghum, and wheat. Careful management is needed to keep crop residue on the soil surface through critical erosion periods. Residue management helps control soil blowing and water erosion and conserve moisture. Residue also helps to maintain soil productivity. Occasionally, emergency tillage is necessary to roughen the soil surface to reduce soil blowing if crop growth does not produce enough residue for protective cover. A properly designed irrigation system and proper application of irrigation water are essential. A surface system or sprinkler system can be used. This soil needs to be fertilized if it is irrigated.

This soil has a medium potential for growing native range plants. Low rainfall limits production. Native range plants are mainly short grasses, which produce medium amounts of forage. Potential for wildlife habitat is medium.

This soil has a high potential for most urban uses. Corrosivity to uncoated steel and low strength are the most limiting factors, but these are easily overcome by good design and careful installation procedures. Potential for recreational uses is medium. The clay loam surface layer is the most limiting feature. Capability subclass IIIe nonirrigated, IIe irrigated; Clay Loam range site.

Lc—Lipan clay, depressional. This deep, nearly level soil is on the bottoms of depressions or shallow playas. Slopes range from 0 to 1 percent but average less than 0.5 percent. The surrounding plains range from 2 to 15 feet higher in elevation than the playa bottoms. Soil areas are circular to oval in shape and range from 10 to 50 acres in size. In undisturbed areas, the surface is characterized by gilgai microrelief consisting of microknolls and microdepressions. The microknolls are 6 to 20 inches higher than the bottoms of the microdepressions. They are 2 to 10 feet across and from 3 to 20 feet apart. Evidence of gilgai microrelief is destroyed after a few years of cultivation.

In the center of a microdepression, the surface layer is very firm, moderately alkaline, gray clay about 22 inches thick. This layer changes gradually to a layer, about 33 inches thick, of very firm, moderately alkaline, gray clay that contains a few slickensides. Between the depths of 55 and 70 inches, the soil is very firm, moderately alkaline, light brownish gray clay and is about 4 percent, by volume, calcium carbonate concretions.

This soil is somewhat poorly drained. Surface runoff is ponded. Runoff from surrounding soils covers this soil to a depth of a few inches to several feet for periods of a few days to several weeks after rains. When dry, this soil has wide, deep cracks that extend to the surface. Water enters the soil rapidly when the soil is cracked. When the soil is wet, the cracks are sealed, and water enters very slowly. Permeability is very slow.

Available water capacity is high. The rooting zone is deep, but clay content tends to impede the movement of air, water, and roots. The erosion hazard is slight, and the soil blowing hazard is moderate.

Included with this soil in mapping are small areas of Lipan soils that have about 25 percent limestone frag-

ments on the surface and throughout the soil. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mainly for range, but a few areas are cultivated. Nonirrigated cotton, grain sorghum, and wheat are the main crops. This soil is not recommended for irrigation.

Potential for growing nonirrigated cotton is high, and potential for nonirrigated grain sorghum and wheat is medium. Keeping crop residue on or near the soil surface helps to prevent soil blowing and conserve moisture. It also helps to improve soil tilth and water intake. In dry years, emergence tillage is needed to help control soil blowing where crop residue does not furnish adequate protection. Farming is hazardous on this soil because of the danger of crops drowning.

This soil has a medium potential for growing native range plants. It is droughty between periods of excessive wetness and produces moderate amounts of forage. Potential for wildlife habitat is medium.

Potential for most urban uses is low. Flooding and shrinking and swelling with changes in moisture, low strength, and corrosivity to uncoated steel are the most restrictive features. Potential for recreational uses is low mainly because of flooding and the clay surface layer. Capability subclass IVw nonirrigated; Lakebed range site.

Ls—Lipan stony clay. This deep, nearly level soil is on bottoms of depressions or shallow playas. Slopes range from 0 to 1 percent but average about 0.5 percent. About 25 to 30 percent loose limestone fragments of cobble and stone size occur on the surface and throughout the soil. This soil is 2 to 15 feet lower than the surrounding soils. Soil areas are circular to oval in shape and range from 10 to 25 acres in size. The surface is characterized by gilgai microrelief consisting of microknolls and microdepressions. The microknolls are 6 to 24 inches higher than the microdepressions and range from 3 to 20 feet apart.

In the center of a microdepression, the surface layer is very firm, moderately alkaline, gray stony clay about 15 inches thick. Limestone cobbles and stones comprise about 30 percent, by volume, of the surface layer. The next layer is very firm, moderately alkaline, grayish brown stony clay about 39 inches thick. Between the depths of 54 and 70 inches, the soil is very firm, moderately alkaline, light brownish gray stony clay.

This soil is somewhat poorly drained. Surface runoff is ponded. Runoff from surrounding soils covers this soil for a long period following rains. When dry, this soil has wide, deep cracks that extend to the surface. Water enters the soil rapidly when the soil is cracked. When the soil is wet, the cracks are sealed, and water enters the soil very slowly. Permeability is very slow.

Available water capacity is high. The rooting zone is deep, but clay content and limestone fragments impede the movement of air, water, and roots. The erosion hazard is slight, and the soil blowing hazard is moderate.

Included in some areas of this soil are small areas of soils similar to Lipan soils, except that bedrock occurs at depths of 20 to 40 inches below the surface. These inclusions comprise less than 15 percent of any one mapped area.

This soil is not suitable for cultivation because of limestone cobbles and stones on the surface. It is used mainly for range.

Potential for growing native range plants is medium. This soil is droughty between periods of excess water; therefore, it produces only moderate amounts of forage. Potential for wildlife habitat is low.

Potential for most urban uses is low. Stony surface, flooding, and shrinking and swelling with changes in moisture, low strength, and corrosivity to uncoated steel are the most restrictive features. Potential for recreational uses is low mainly because of flooding and the stony clay surface layer. Capability subclass VIw nonirrigated; Lakebed range site.

MeB—Mereta clay loam, 1 to 3 percent slopes. This shallow, gently sloping soil is on uplands, mainly on outwash plains. Some areas occur as side slopes around playas. Slopes average about 1.5 percent. Areas are irregular in shape and range from 30 to several hundred acres in size.

This soil has a surface layer of friable, moderately alkaline clay loam about 17 inches thick. This layer is dark brown in the upper 7 inches and brown in the lower 10 inches. It has an abrupt boundary underlain by a layer of whitish indurated caliche (fig. 11). This layer is about 18 inches thick. Between the depths of 35 and 60 inches the soil is pink, weakly cemented caliche that has a texture of clay loam.

This soil is well drained. Surface runoff is slow. Permeability is moderately slow, and available water capacity is low. The rooting zone is shallow. The erosion hazard is moderate, and the soil blowing hazard is slight.

Included with this soil in mapping are small areas of Angelo, Conger, and Ector soils. Included soils make up less than 15 percent of any one mapped area.

This soil is suitable for growing nonirrigated crops, but is used mainly for range. It is not suitable for growing irrigated crops.

Potential for growing nonirrigated cotton, grain sorghum, and wheat is medium. If this soil is cultivated, careful management is needed to conserve moisture and control soil blowing and water erosion. Crop residue left on or near the soil surface help protect the soil during critical erosion periods. Contour farming, terraces, and grassed waterways help to control outside or excess runoff. When cuts or excavations exceed a depth of 14 inches, there is a hazard of cutting into a layer of indurated caliche.

This soil has a low potential for growing native range plants. Low rainfall, low available water capacity, and shallow rooting depth limit the amount of forage produced. Potential for wildlife habitat is medium.

The potential for most urban uses is medium. Shallow depth to indurated caliche, restricted percolation, and high corrosivity to uncoated steel are the most limiting

features. These limitations can be overcome by good design and careful installation procedures. The potential for most recreational uses is medium. The clay loam surface layer is the most limiting feature. Capability subclass IIIe nonirrigated; Shallow range site.

MfA—Midessa fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on upland plains. Slopes average about 0.6 percent. Areas are irregular in shape and range from 15 to several hundred acres in size.

The surface layer is very friable, moderately alkaline, brown fine sandy loam about 9 inches thick. The next layer is very friable, moderately alkaline sandy clay loam about 25 inches thick. It is brown in the upper 10 inches and light brown in the lower 15 inches. The next layer is friable, moderately alkaline, pink clay loam about 24 inches thick, and is about 45 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate. Between the depths of 58 and 80 inches, the soil is friable, moderately alkaline, light reddish brown clay loam and is about 25 percent, by volume, calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is medium. The rooting zone is deep and easily penetrated by plant roots. The erosion hazard is slight, and the soil blowing hazard is moderate.

Included with this soil in mapping are small areas of Amarillo and Reagan soils. Also included are a few small areas of Midessa soils that have slopes of 1 to 3 percent. These inclusions make up less than 15 percent of any mapped area.

This soil is used as cropland and range. Cotton and grain sorghum are the main cultivated crops.

Potential for growing nonirrigated and irrigated cotton or grain sorghum is high. Keeping crop residue on or near the soil surface helps conserve moisture and helps protect the soil from water erosion and soil blowing. In dry years, emergency tillage is needed to control soil blowing where crop residue does not provide adequate protection. Diversion terraces and grassed waterways can be used to intercept and remove excess runoff. A properly designed irrigation system and proper application of irrigation water are necessary. Either a surface irrigation system or sprinkler irrigation system can be used. Fertilizer is needed if the soil is irrigated.

Potential for growing native range plants is high. Yields of short and mid grasses are good during favorable years. Potential for wildlife habitat is medium.

This soil has a high potential for most urban uses. It is corrosive to uncoated steel, has low strength when used for streets and roads, and presents seepage problems when used for sewage lagoons. However, these limitations can be easily overcome by good design and careful installation procedures. Potential for recreational uses is high. Capability subclass IIIe nonirrigated, IIe irrigated; Sandy Loam range site.

MfB—Midessa fine sandy loam, 1 to 3 percent slopes. This deep gently sloping soil is on upland plains. Slopes average about 2 percent. Areas are irregular in shape and range from 15 to several hundred acres in size.

This soil has a surface layer of very friable, moderately alkaline, brown fine sandy loam about 8 inches thick. The next layer is very friable, moderately alkaline sandy clay loam about 22 inches thick. It is brown in the upper 9 inches and light brown in the lower 13 inches. The next layer is friable, moderately alkaline, pink clay loam about 22 inches thick and is about 40 percent, by volume, calcium carbonate. Between the depths of 52 and 70 inches, the soil is friable, moderately alkaline, light reddish brown clay loam and is about 30 percent, by volume, calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The rooting zone is deep and easily penetrated by plant roots. The water erosion and soil blowing hazards are moderate.

Included with this soil in mapping are small areas of Amarillo and Reagan soils. Also included are small areas of Midessa soils that have slopes of 0 to 1 percent. Inclusions make up less than 20 percent of any one mapped area.

This soil is used mainly for range, but a few areas are cultivated. When the soil is cultivated, cotton and grain sorghum are the main crops.

Potential for growing nonirrigated and irrigated cotton or grain sorghum is medium. Crop residue needs to be kept on or near the soil surface. Residue is necessary to help control water erosion and soil blowing and to help conserve moisture. In dry years, emergency tillage is needed to help control soil blowing when crop residue does not furnish adequate protection. Contour farming, terraces, and grassed waterways are needed to help control water erosion. If the soil is irrigated, a properly designed irrigation system and proper application of irrigation water are essential. A sprinkler irrigation system is best adapted. If a surface system is used, bench leveling is necessary. Fertilizer is needed if the soil is irrigated.

Potential for growing native range plants is high. Low rainfall is the most limiting factor, but yields of short and mid grasses are good during favorable years. Potential for wildlife habitat is medium.

Potential for most urban uses is high. Slope, seepage, low strength, and corrosivity to uncoated steel are the most restrictive features, but these are easily overcome by good design and careful installation procedures. Potential for recreational uses is high. Slope restricts some playground uses. Capability subclass IIIe nonirrigated, IIIe irrigated; Sandy Loam range site.

MfC—Midessa fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on uplands, mainly along natural drainageways. Slopes average about 4 percent. Areas are oblong in shape and range from 15 to 250 acres in size.

The surface layer is very friable, moderately alkaline, brown fine sandy loam about 8 inches thick. The next

layer is very friable, moderately alkaline, light brown sandy clay loam about 20 inches thick. Between the depths of 28 and 70 inches, the soil is friable, moderately alkaline, pink clay loam and is about 25 percent, by volume, calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The rooting zone is deep. The erosion hazard is severe, and the soil blowing hazard is moderate.

Included with this soil in mapping are Midessa soils that have slopes of 1 to 3 percent and small areas of a soil similar to Midessa fine sandy loam except that it has a slightly sandier surface layer and it does not have accumulations of calcium carbonate in the lower layers. These inclusions make up less than 20 percent of any one mapped area.

This soil is used mainly for range. It can be planted to nonirrigated grain sorghum or wheat. It is not suitable for irrigated crops, nor is it suitable for nonirrigated cotton.

Potential for growing nonirrigated grain sorghum or wheat is low. Low rainfall, slope, and susceptibility to water erosion are the most limiting factors. If the soil is cultivated, it is necessary to keep crop residue on or near the surface to conserve moisture and to help control water erosion and soil blowing. Contour farming, terraces, and grassed waterways are necessary to help control excess runoff. Emergency tillage is needed during dry years, when crop residue does not provide adequate protection. Potential for growing native range plants is high. Good range management is needed to prevent this soil from eroding. Potential for wildlife habitat is medium. This soil has a high potential for most urban uses. Slope, seepage when used for sewage lagoons, low strength when used for streets and roads, and corrosivity to uncoated steel are the most restrictive features. These limitations are easily overcome by good design and careful installation procedures. Potential for recreational uses is high. Slope restricts some playground uses. Capability subclass IVe nonirrigated; Sandy Loam range site.

MoC—Monahans fine sandy loam, 1 to 5 percent slopes. This deep, gently sloping soil is on upland plains. Slopes average about 4 percent. Areas are oblong to irregular in shape and range from 10 to 150 acres in size.

The surface layer of this soil is very friable, moderately alkaline, pale brown fine sandy loam about 6 inches thick. The next layer is very friable, moderately alkaline, very pale brown loam about 11 inches thick. Between the depths of 17 and 36 inches, the soil is very friable, moderately alkaline, pink loam and is about 40 percent, by volume, soft calcium carbonate and gypsum material. Between the depths of 36 and 60 inches, the soil is very friable, moderately alkaline, pink loam.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is medium. The rooting zone is deep, but a high percentage of calcium carbonate and gypsum at 17 inches restricts some root growth. The erosion and soil blowing hazards are moderate.

Included with this soil in mapping are small areas of Cottonwood soils. Also included are small areas of Monahans soils that have slopes of 6 to 8 percent. Inclusions make up less than 15 percent of any one mapped area.

This soil is not suitable for cultivation. Slope, shallow depth to a layer containing calcium carbonate and gypsum, and susceptibility to water erosion and soil blowing restrict use of the soil to range. Potential for growing native range plants is high. Yields of forage are good during favorable years. Potential for wildlife habitat is medium.

This soil has a high potential for most urban uses. Slope, seepage, low strength, and corrosivity to uncoated steel and concrete are the most limiting features. However, these limitations are easily overcome by good design and careful installation procedures. Potential for recreational uses is medium. Slope and the dusty surface layer are the most restrictive features. Capability subclass VIe nonirrigated; Sandy Loam range site.

PaB—Patricia loamy fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on upland plains. Slopes average about 2 percent. Areas are irregular in shape and range from 25 to several hundred acres in size.

This soil has a surface layer of friable, neutral, reddish brown loamy fine sand about 14 inches thick. The next 32 inches consists of friable, neutral, red sandy clay loam. Between the depths of 46 and 80 inches, the soil is friable, mildly alkaline sandy clay loam. It is yellowish red in the upper 18 inches and reddish yellow in the lower 16 inches.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is medium. The rooting zone is deep and is easily penetrated by plant roots. The water erosion hazard is slight, and the soil blowing hazard is severe.

Included with this soil in mapping are small areas of Amarillo, Pyote, and Springer soils. Also included are oblong sandy mounds that are 1 to 3 feet higher than the surrounding soils and 4 to 20 feet wide. They are around the edges of some cultivated fields. Included in areas of range are sandy mounds that are 6 to 12 inches high and 2 to 4 feet in diameter. These areas are around the bases of mesquite trees. Inclusions make up less than 15 percent of any one mapped area.

This soil is used mainly for range, but it can be cultivated. When this soil is cultivated, cotton and grain sorghum are the main crops.

This soil has a high potential for growing nonirrigated and irrigated cotton and grain sorghum. Careful management is needed to prevent soil blowing. Crop residue needs to be left on or near the soil surface, and deep plowing is needed to increase the clay content of the surface layer. Emergency tillage helps control soil blowing when crop residue does not furnish adequate protection. Contour farming, terraces, and grassed waterways help control excess runoff. A properly designed irrigation system and proper application of irrigation water are essential. This soil is suitable only for sprinkler irrigation systems. Fertilizer is needed if this soil is irrigated.

This soil has a high potential for growing native range plants. Native plants are mainly tall grasses, which produce good yields of forage during favorable years. Potential for wildlife habitat is medium.

This soil has a high potential for most urban uses. Seepage and low strength are the most limiting factors. Potential for recreational uses is medium. The loamy fine sand surface layer is the most limiting feature. Capability subclass IVe nonirrigated, IIIe irrigated; Loamy Sand range site.

PoD—Potter soils, 3 to 8 percent slopes. This mapping unit consists of very shallow, gently sloping to sloping soils on uplands. These soils are not uniform and do not occur in a regular pattern. They mainly are on broad, convex ridges and divides. Areas are mostly oblong in shape and range from 30 to 100 acres in size.

The soils in this unit have a surface layer of friable, moderately alkaline, brown loam about 7 inches thick. This layer is about 20 percent soft masses of calcium carbonate, about 20 percent concretions of calcium carbonate, and about 5 to 10 percent fragments of hard caliche. Between the depths of 7 and 19 inches, the soil is white, slightly platy caliche that can be cut with a spade. Between the depths of 19 and 30 inches, it is white, loamy material that contains about 60 percent caliche fragments and soft caliche.

These soils are well drained. Surface runoff is rapid. Permeability is moderate, and available water capacity is very low. The rooting zone is very shallow, but some plant roots penetrate the caliche layer. The water erosion hazard is moderate. The soil blowing hazard is slight.

Included with this soil in mapping are small areas of Midessa soils. The Midessa soils make up less than 15 percent of any one mapped area.

These soils are not suitable for cultivation because of slope, very shallow rooting depth, high caliche content, and susceptibility to water erosion. They are used mainly for range. In some areas, the layers of caliche underlying these soils are mined and used as sources of fill material in road construction.

Potential for growing native range plants is low. Low rainfall, very low available water capacity, and very shallow rooting depth restricts the amount of forage grown on these soils. Potential for wildlife habitat is also low.

The soils in this unit have a medium potential for most urban uses. Seepage and depth to rock are the most limiting features. Potential for recreational uses is high. Slope and small stones limit some playground uses. Capability subclass VIIs, nonirrigated; Very Shallow range site.

PyC—Pyote fine sand, 0 to 5 percent slopes. This deep, nearly level to gently sloping soil is on uplands. Areas are irregular in shape and range up to several hundred acres in size.

This soil has a surface layer of loose, slightly acid fine sand about 26 inches thick. It is brown in the upper 6 inches and light brown in the lower 20 inches. The next layer is very friable, slightly acid, reddish yellow loamy fine sand about 20 inches thick. The next lower layer, to a depth of about 60 inches, is very friable, neutral, reddish yellow loamy fine sand. Between the depths of 60 and 80 inches, the soil is loose, strongly acid, reddish yellow fine sand.

This soil is well drained. Surface runoff is very slow. Permeability is moderately rapid, and available water capacity is low. The rooting zone is deep and is easily penetrated by plant roots. The water erosion hazard is slight, and the soil blowing hazard is severe.

Included with this soil in mapping are small areas of Patricia soils and Springer soils and a few areas of a soil that is similar to Pyote fine sand except that the underlying layers are also fine sand. Inclusions make up less than 15 percent of any one mapped area.

This soil is not suitable for cultivation mainly because of the severe soil blowing hazard. A few areas have been cultivated in the past, but are now abandoned. In some old cultivated areas, fence-row dunes are as much as 8 feet high.

This soil is used mainly for range. Potential for growing native range plants is medium. The vegetation is mainly tall grasses. However, low available plant moisture during the growing season limits yields. Potential for wildlife habitat is medium if the site is close to grain and seed crops.

This soil is a good source of road fill. It has a high potential for most urban uses. The main problem is seepage when this soil is used as a site for reservoir areas or sewage lagoons. Potential for recreational uses is medium. The fine sand surface layer is the most restricting feature. Capability subclass VIe, nonirrigated; Sandy range site.

ReA—Reagan silty clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands, mainly on limestone plateaus, on alluvial fans, and in valley fill. Slopes average about 0.6 percent. Areas are irregular in shape and range from 20 to several thousand acres in size.

The surface layer is friable, moderately alkaline silty clay loam about 10 inches thick. It is dark brown in the upper 4 inches and brown in the lower 6 inches. The next layer is friable, moderately alkaline silty clay loam about 19 inches thick. It is brown in the upper 9 inches and light brown in the lower 10 inches. Between the depths of 29 and 58 inches, the soil is friable, moderately alkaline, pink clay loam and is about 40 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate. Between the depths of 58 and 80 inches, the soil is friable, moderately alkaline, reddish yellow clay loam and is about 20 percent, by volume, calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The rooting zone is deep, and the soil is easily penetrated by plant roots. The water erosion hazard is slight, and the soil blowing hazard is moderate.

Included with this soil in mapping are small areas of Angelo, Conger, Lipan, and Midessa soils. Also included are small areas of Reagan soils that have slopes of 1 to 3

percent. Inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland and range. Cotton and grain sorghum are the main crops. Most of the areas in cultivation are irrigated. Nonirrigated cotton does not grow well on this soil.

Potential for growing irrigated cotton and nonirrigated or irrigated grain sorghum is high. Keeping crop residue on or near the soil surface helps protect the soil from water erosion and soil blowing and helps conserve moisture. In dry years, emergency tillage is needed to control soil blowing where crop residue does not provide adequate protection. A properly designed irrigation system and proper application of irrigation water are necessary. A surface or sprinkler system can be used. Fertilizer is needed when this soil is irrigated.

This soil has a medium potential for growing native range plants. Low rainfall limits this soil to moderate yields of mid and short grasses. Potential for wildlife habitat is also medium.

Potential for most urban uses is medium. This soil shrinks and swells with changes in moisture. It is corrosive to uncoated steel, has low strength, and seeps when used for sewage lagoons. Potential for recreational uses is medium. The silty clay loam surface layer is too clayey and is dusty. Capability subclass IVc nonirrigated, capability class I, irrigated; Loamy range site.

ReB—Reagan silty clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands, mainly on limestone plateaus, on alluvial fans, and around playas. Slopes average about 2 percent. Areas are irregular to elongated in shape and range from 15 to 300 acres in size.

This soil has a surface layer of friable, moderately alkaline, brown silty clay loam about 7 inches thick. The next layer is friable, moderately alkaline silty clay loam about 18 inches thick. It is brown in the upper 8 inches and light brown in the lower 10 inches. Between the depths of 25 and 45 inches, the soil is friable, moderately alkaline, pink clay loam and is about 35 percent, by volume, calcium carbonate. Between depths of 45 and 76 inches, the soil is friable, moderately alkaline, reddish yellow clay loam and is about 20 percent, by volume, calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The rooting zone is deep and soil is easily penetrated by plant roots. The water erosion hazard and the soil blowing hazard are moderate.

Included with this soil in mapping are small areas of Conger soils and Rioconcho soils. Also included are small areas of Reagan soils that have slopes of 0 to 1 percent. Inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland and range. Cotton and grain sorghum are the main crops. Nonirrigated cotton does not grow well on this soil.

Potential for growing irrigated cotton is high. Potential for growing nonirrigated or irrigated grain sorghum is medium. Crop residue needs to be left on or near the soil surface to help protect the soil from water erosion and soil blowing. Residue also helps to conserve moisture. In dry years, emergency tillage is needed to control soil blowing where crop residue does not provide adequate protection. Contour farming and terraces are needed on this soil. Grassed waterways make good outlets for terrace systems when excess water is a problem. When cuts or excavations exceed 20 inches, there is a hazard of cutting into soil material that contains concentrations of calcium carbonate. A properly designed irrigation system and proper application of irrigation water are necessary. A sprinkler irrigation system is best adapted. Some bench leveling is needed if a surface irrigation system is used. Fertilizer is needed if this soil is irrigated.

Potential for growing native range plants is medium. Low rainfall limits production of this soil to moderate yields of mid and short grasses during favorable years. Potential for wildlife habitat is medium.

Potential for most urban uses is medium. Shrinking and swelling with changes in moisture, low strength, corrosivity to uncoated steel, and seepage when used for sewage lagoons are the main limiting features. Potential for recreational uses is medium. The silty clay loam surface layer is too clayey and dusty. Slope restricts some playground uses. Capability subclass IVe nonirrigated, IIe irrigated; Loamy range site.

Ro—Rioconcho silty clay. This deep, nearly level soil is on flood plains of streams. It is occasionally flooded by runoff from adjacent slopes. Slopes of this soil range from 0 to 1 percent but average about 0.5 percent. Areas are long and narrow. Some areas are several miles long and range up to 0.5 mile wide.

This soil has a surface layer of friable, moderately alkaline, very dark grayish brown silty clay about 16 inches thick (fig. 12). The next layer is very firm, moderately alkaline, dark brown silty clay about 26 inches thick. The next 20 inches is moderately alkaline, brown silty clay. It is very firm and is about 5 percent, by volume, calcium carbonate concretions in the upper 10 inches and is firm and contains no concretions in the lower 10 inches. Between the depths of 62 and 80 inches, the soil is friable, moderately alkaline, brown silty clay loam.

This soil is moderately well drained. Surface runoff and permeability are slow. Available water capacity is high. The rooting zone is deep. The water erosion and soil blowing hazards are slight.

Included with this soil in mapping are small areas of Angelo soils and Bippus soils. They comprise less than 10 percent of any one mapped area.

This soil is used as cropland and range. Cotton and grain sorghum are the main crops.

Potential for growing nonirrigated and irrigated cotton or grain sorghum is high. Keeping crop residue on or near the soil surface helps control water erosion, prevent soil blowing, and conserve moisture. Diversion terraces help protect this soil from runoff from adjacent slopes. If this soil is irrigated, a well-designed irrigation system and

proper application of irrigation water are necessary. A surface or sprinkler system can be used. Fertilizer is needed if this soil is irrigated.

This soil has a high potential for growing native range plants. Low rainfall is the most limiting factor. Potential for wildlife habitat is high.

Potential for urban uses is low. Occasional flooding, slow percolation, shrinking and swelling with changes in moisture, and low strength are the most restrictive features. Potential for recreational uses is low mainly because of the silty clay surface layer. Capability subclass IIc nonirrigated, capability class I irrigated; Clayey Bottomland range site.

ScA—Slaughter clay loam, 0 to 1 percent slopes. This shallow, nearly level soil is on upland plains. Slopes average about 0.7 percent. Most of this soil is in one irregularly shaped area about 180 acres in size.

This soil has a surface layer of friable, neutral, reddish brown clay loam about 8 inches thick. The next layer is firm, mildly alkaline, reddish brown clay loam about 10 inches thick. It has an abrupt boundary and is underlain by a layer of white indurated caliche. The indurated caliche layer is 6 to 24 inches thick over softer caliche that is several feet thick.

This soil is well drained. Surface runoff is slow. Permeability is moderately slow. Available water capacity is low. The rooting zone is shallow. The water erosion and soil blowing hazards are slight.

Included with this soil in mapping are small areas of Blakeney soils that make up less than 5 percent of the mapped area.

This soil is not cultivated. The size and shape of the mapped area and the shallow depth to indurated caliche restrict the use of the soil to range. Potential for growing native range plants is medium. Low rainfall, low available water capacity, and shallow rooting depth limit the amount of forage grown. Potential for wildlife habitat is medium if grain and seed crops are grown nearby.

Potential for most urban uses is low. Shallow depth to indurated caliche is the most restrictive factor. Potential for recreational uses is medium mainly because of the clay loam surface layer. Capability subclass IVs nonirrigated; Clay Loam range site.

SpB—Springer loamy fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on uplands. Slopes are slightly convex and average about 2 percent. Areas are irregular in shape and range from 50 to 300 acres in size.

The surface layer of this soil is very friable, neutral, brown loamy fine sand about 17 inches thick. The next layer is friable, mildly alkaline, yellowish red fine sandy loam about 21 inches thick. Between the depths of 38 and 80 inches, the soil is friable, mildly alkaline, reddish yellow fine sandy loam.

This soil is well drained. Surface runoff is slow. Permeability is moderately rapid, and available water capacity is medium. The rooting zone is deep and is easily penetrated by plant roots. The water erosion hazard is slight, and the soil blowing hazard is severe.

Included with this soil in mapping are small areas of Patricia soils and Pyote soils. Also included are sandy mounds that are the result of soil blowing. They are along fence rows and around mesquite trees. Inclusions make up less than 15 percent of any one mapped area.

This soil is used mainly for range. It can, however, if carefully managed, be used for growing nonirrigated and irrigated cotton or grain sorghum. It is not suitable for growing wheat.

Potential for growing nonirrigated and irrigated cotton or grain sorghum is medium. Careful management is needed to prevent soil blowing. Crop residue needs to be left on or near the soil surface. Deep plowing is needed to increase the clay content of the surface layer. Emergency tillage helps control soil blowing when crop residue does not furnish adequate protection. Contour farming, terraces, and grassed waterways help control excess runoff. A well-designed irrigation system and proper application of irrigation water are essential. This soil is suitable only for sprinkler irrigation systems. Fertilizer is needed if the soil is irrigated.

This soil has a high potential for growing native range plants. Native vegetation is mainly tall grasses, which produce good yields of forage during favorable years. Potential for wildlife habitat is medium if the site is located near grain and seed crops.

This soil has a high potential for most urban uses. Seepage is the most limiting factor. Potential for recreational uses is medium. The loamy fine sand surface layer is the most limiting factor. Capability subclass IVe nonirrigated, IIIe irrigated; Loamy Sand range site.

ToA—Tobosa clay, 0 to 1 percent slopes. This deep, nearly level soil is on uplands, mainly in wide valleys and on wide divides and low mesas. Areas are irregular in shape and range from 10 to 400 acres in size. Slopes are slightly concave. In undisturbed areas, the surface is characterized by weakly expressed gilgai microrelief. The gilgai microrelief consists of microflats and microdepressions. The microdepressions are 4 to 20 inches deep and 2 to 4 feet across. Evidence of gilgai microrelief is destroyed during normal cultivation procedures.

In the center of a microflat, the surface layer is very firm, moderately alkaline clay about 24 inches thick. It is dark grayish brown in the upper 7 inches and dark brown in the lower 17 inches. The next layer is about 32 inches thick and is very firm, moderately alkaline, dark brown clay. It contains a few intersecting slickensides. Between the depths of 56 to 65 inches, the soil is firm, moderately alkaline, reddish yellow silty clay loam and is about 20 percent, by volume, calcium carbonate concretions.

This soil is well drained. Surface runoff is slow. When it is dry, this soil has deep, wide cracks that extend to the surface. Water enters the soil rapidly when the soil is cracked. When the soil is wet, the cracks are sealed, and water enters the soil very slowly. Permeability is very slow. Available water capacity is high. The rooting zone is deep, but clay content tends to impede the movement of air, water, and roots. The water erosion hazard is slight, and the soil blowing hazard is moderate.

Included with this soil in mapping are small areas of Mereta soils and Tobosa soils that have slopes of 1 to 2 percent. Also included are a few areas that have large limestone rocks on the surface. These areas comprise up to 20 percent of the mapped area. However, most mapped areas contain less than 15 percent inclusions.

This soil is used mainly for range, but a few areas are cultivated. Nonirrigated cotton, grain sorghum, and wheat are the main crops. Irrigation is not recommended for this soil.

Potential for growing nonirrigated cotton, grain sorghum, and wheat is high. Crop residue left on or near the soil surface helps control water erosion, prevent soil blowing, and conserve moisture. It also helps to improve soil tilth and water intake. In dry years, emergency tillage helps to control soil blowing where crop residue does not furnish adequate protection.

This soil has a medium potential for growing native range plants. It is droughty and produces moderate amounts of forage. Potential for wildlife habitat is medium.

Potential for most urban uses is low. Shrinking and swelling with changes in moisture, low strength, and corrosivity to uncoated steel are the most restrictive features. Potential for recreational uses is low mainly because of the clay surface layer. Capability subclass IIIs nonirrigated; Clay Flat range site.

Planning the Use and Management of the Soils

The soil survey is a detailed analysis and evaluation of the most basic resource of the survey area—the soil. It may be used to fit the use of the land, including urbanization, to the limitations and potentials of the natural resources and the environment and to help avoid soil-related failures in uses of the land.

During a soil survey soil scientists, conservationists, engineers, and others keep extensive notes, not only about the nature of the soils but also about unique aspects of behavior of these soils in the field and at construction sites. These notes include observations of erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic systems, and other factors relating the kinds of soil and their productivity, potentials, and limitations under various uses and management. In this way field experience incorporated with measured data on soil properties and performance is used as a basis for predicting soil behavior.

Information in this section will be useful in applying basic facts about the soils to plans and decisions for use and management of soils for cultivated crops, range, and many nonfarm uses, including building sites, highways and other transportation systems, sanitary facilities, parks and other recreational developments, and wildlife habitat. From the data presented, the potential of each soil for specified land uses may be determined, soil limitations to these land uses may be identified, and costly failures in homes and other structures, because of unfavorable soil properties, may be avoided. A site can be selected where the soil properties are favorable, or practices can be planned that will overcome the soil limitations.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area, and on the environment. Both of these factors are closely related to the nature of the soil. Plans can be made to maintain or create a land use pattern in harmony with the natural soil.

Contractors can find information useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock or cemented layers that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, trees and shrubs, and most other uses of land are influenced by the nature of the soil.

Cultivated Crops

The major management concerns when using the soils for cultivated crops are described in this section. In addition, the crops best adapted to the soils in the survey area are discussed; irrigation is briefly discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the predicted yields of the main crops are presented for each soil.

This section provides information about the overall agricultural potential and needed practices in the survey area for those in the agribusiness sector—equipment dealers, drainage contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil Maps for Detailed Planning." When making plans for management systems for individual fields or farms, consider the detailed information given in the description of each soil.

In 1967, about 50,914 acres in the survey area were used for crops, according to "Conservation Needs Inventory" (*3*).

The most restrictive factor limiting the use of Glasscock County soils for cultivated crops is low rainfall. The potential of the soils for increased production of food is high, but the lack of rainfall and irrigation water restricts use of many of the soils to range.

Other management concerns are the water erosion and soil blowing hazards.

Water erosion is a hazard on the loamy, gently sloping Amarillo, Angelo, Arvana, Broome, Mereta, Midessa, and Reagan soils. Runoff can damage these soils if they are not protected. Vegetative cover and mechanical measures, such as contour farming, terraces, and grassed waterways, help minimize water erosion on these soils.

Soil blowing is a severe hazard on the sandy Patricia and Springer soils. It is a moderate hazard on the loamy or clayey Amarillo, Arvana, Estacado, Lipan, Midessa, Reagan, and Tobosa soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces, through proper tillage, minimizes soil blowing on these soils.

Loss of the surface layer by water erosion or soil blowing is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a clayey subsoil, such as the Angelo soils, and on soils with a layer that limits the depth of the root zone, such as indurated caliche layers in the Arvana soils and Mereta soils. Second, runoff from farmland deposits sediment in streams. Control of water erosion minimizes sedimentation and improves the quality of water for municipal use, for recreation, and for fish and wildlife. Soil blowing pollutes the air and deposits drifts of productive soil material along fence rows, in bar ditches, and across roads.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that do not reduce the productive capacity of the soils.

Minimum tillage and leaving crop residue on or near the soil surface help to increase infiltration and to reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area, but are more difficult to use successfully on the soils that have a clayey surface layer, such as the Lipan, Rioconcho, and Tobosa soils.

Deep plowing increases the clay content of the surface layer of the Patricia and Springer soils. An increase in clay content in the surface layer of these sandy soils helps reduce the hazard of soil blowing.

Emergency tillage helps control soil blowing if crop residue does not furnish adequate protection. Tillage is used to roughen the soil surface so that the soil is more resistant to movement by the wind. The Amarillo, Arvana, Estacado, Lipan, Midessa, Patricia, Reagan, Springer, and Tobosa soils are suitable for emergency tillage.

Contour farming is also an erosion control practice used in the survey area. It is best adapted to soils with smooth, uniform slopes, including most areas of the gently sloping Amarillo, Angelo, Arvana, Broome, Mereta, Midessa, Patricia, Reagan, and Springer soils.

Grassed waterways minimize soil erosion by slowing the velocity of runoff. They are also good outlets for terraces or diversions.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are more practical on deep, well drained soils that have regular slopes. Amarillo, Midessa, Patricia, and Springer soils are suitable for terraces. The other soils are less suitable for terraces and diversions because of irregular slopes; a clayey subsoil, which would be exposed in terrace channels, as in Angelo soils; high concentration of calcium carbonate at a depth of less than 30 inches, as in Broome and Reagan soils; or indurated caliche at a depth of less than 30 inches, as in Arvana and Mereta soils.

Information for the design of erosion control practices for each kind of soil is contained in the "technical guide," available in local offices of the Soil Conservation Service.

Soil drainage is a management need on the somewhat poorly drained Lipan soils, which make up about 5,670 acres in the survey area.

Soil fertility is naturally medium to low in most of the cultivated soils on uplands in the survey area. Additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Agricultural Extension Service can help determine the kinds and amounts of fertilizer to apply. None of the soils require additions of lime.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Most of the soils used for cultivated crops in the survey area are loamy and can be plowed in the fall. However, some of the gently sloping, loamy soils are subject to damaging water erosion if they are plowed in the fall. Also, maintenance of residue on or near the soil surface is important for those soils subject to soil blowing.

The Lipan, Rioconcho, and Tobosa soils are clayey, and tilth is a problem. If they are wet when plowed, they tend to be very cloddy when dry and good seedbeds are difficult to prepare. Fall plowing generally results in good tilth in the spring. Soil blowing is a problem if these soils are left bare.

Field crops suited to the soils and climate of the survey area include cotton, grain sorghum, and wheat. Cotton and grain sorghum are row crops, and wheat is a close-growing crop.

Special crops are vegetables and nursery plants. Many vegetables are especially suited to deep soils that have good natural drainage and that warm up early in the spring. Production is limited mainly by amount of rainfall or availability of irrigation water.

The latest information and suggestions for growing field crops or special crops can be obtained from local offices of the Agricultural Extension Service and the Soil Conservation Service.

Irrigation

A limited number of acres are irrigated in Glasscock County. In 1973, approximately 8,000 acres were irrigated.

The largest irrigated area is in the St. Lawrence Community. Smaller areas occur in the northwestern and northeastern parts of the county.

All water used for irrigation is pumped from deep wells. Most of the wells are 150 to 300 feet deep. These wells produce from 25 to 1,200 gallons per minute.

Both surface irrigation systems and sprinkler irrigation systems are used. In some places, land leveling or land smoothing is necessary before a surface irrigation system can be installed. Row irrigation is used mainly on the nearly level, clayey and loamy soils. Sprinkler irrigation systems are used on the gently sloping, loamy soils and on the nearly level to gently sloping, sandy soils. If a surface system is used on the gently sloping loamy soils, bench leveling is necessary.

Yields of irrigated crops are two to five times greater than yields from nonirrigated crops.

Capability Classes and Subclasses

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. This classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range or for engineerng purposes.

In the capability system, all kinds of soils are grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use. (none in the county)

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial plants. (none in the county)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, range, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 3. All land in the county except borrow pits, gravel pits, urban land, water area, and other miscellaneous areas is included. Data in this table can be used to determine the farming potential of the area.

The capability subclass is identified in the description of each soil mapping unit in the section "Soil Maps for Detailed Planning."

Yields Per Acre

The per acre average yields that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in table 4 because of seasonal variations in rainfall and other climatic factors. Absence of a yield estimate indicates that the crop is not suited to or not commonly grown on the soil or that irrigation of a given crop is not commonly practiced on the soil.

The predicted yields are based mainly on the experience and records of farmers, conservationists, and Extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The latest soil and crop management practices used by many farmers in the county are assumed in predicting the yields. A few farmers may be using more advanced practices and are obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends upon the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for

each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops it is assumed that the irrigation system is adapted to the soils and to the crop grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The predicted yields reflect the relative productive capacity of the soils for each of the principal crops. Yields are likely to increase in the future as new production technology is developed. The relative productivity of a given soil compared to other soils, however, is not likely to change.

Crops other than those shown in table 4 are grown in the survey area, but because their acreage is small, predicted yields for these crops are not included. The local offices of the Soil Conservation Service and the Agricultural Extension Service can provide information about the productivity and management concerns of the soils for these crops.

Range

RUDY J. PEDERSON, range conservationist, Soil Conservation Service, assisted in preparing this section.

Range is land on which the natural potential plant community of the soil is composed of grasses, forbs, and shrubs that are valuable for grazing. About 487,434 acres in the survey area were used for range in 1967, according to "Conservation Needs Inventory" (*3*). This acreage has been used for the production of native vegetation and is grazed by domestic livestock and deer. Acreage in range and the number of ranches has gradually decreased over the years. At present, there are about 150 ranches and farms producing livestock in the county.

Most of the soils in the county produce a mixture of plants suitable for grazing by cattle and sheep. A few stocker-type lambs and calves are grazed. Deer and other wildlife are increasing in number and value, but at present they use only a small part of the forage produced.

Where climate and topography are about the same, differences in the kind and amount of vegetation that range can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 5 shows, for each kind of soil, the name of the range site, the potential annual production of herbage in favorable, normal, and unfavorable years, and the names of major plant species and the percentage of each in the composition of the potential plant community.

A range site supports a distinctive potential plant community, or combination of plants, that can grow on a site that has not undergone major disturbance. Soils that produce the same kind, amount, and proportion of range plants are grouped into range sites. Range sites can be interpreted directly from the soil map where the relationships between soils and vegetation have been correlated. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on range plants and their productivity. Soil reaction, soil depth, and available water capacity are also important.

Potential production refers to the amount of herbage that can be expected to grow on well-managed range that is supporting the potential plant community. It is expressed in pounds per acre of air-dry herbage for favorable, normal, and unfavorable years. A favorable year is one in which the amount and distribution of precipitation and the temperatures result in growing conditions substantially better than average; a normal year is one in which these conditions are about average for the area; an unfavorable year is one in which growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry herbage produced per acre each year by the potential plant community. All herbage, both that which is highly palatable and that which is unpalatable to livestock, is included. Some of the herbage also may be grazed extensively by wildlife and some of it not. Plant species that have special value for livestock forage are mentioned in the description of each soil mapping unit.

Common names are listed for the grasses, forbs, and shrubs that make up most of the potential plant community on each soil. Under the heading Composition in table 5, the proportion of each species is presented as the percentage, in dry-weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the season when the forage is grazed. All of the herbage produced is normally not used.

Range management requires, in addition to knowledge of the kind of soil and the potential plant community, an evaluation of the present condition of the range vegetation in relation to its potential production. Range condition is an expression of how the present plant community compares with the potential plant community on a particular kind of soil and range site. The more nearly alike the present kinds and amounts of plants and the potential plant community, the better the range condition. The usual objective in range management is to manage grazing so that the plants growing on a site are about the same in kind and amount as the potential native plant community for that site. Such management generally results in the maximum production of herbage, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential fits grazing needs, provides wildlife habitat, or provides other benefits, as well as protecting soil and water resources.

The soils of the limestone hills, mainly in the northeastern and eastern parts of the county, produce a few browse plants, as well as grasses and forbs. This area is well suited to grazing by sheep. The deeper soils in the valleys and the lower lying plains have a natural potential to produce a mixture of medium and short grasses, some

forbs, and woody plants. Mesquite has increased and invaded on the deeper soils. Cedar has increased on the shallow and very shallow soils. The nearly level plain in the southern part of the county is a silty clay loam that produces a semidesert grassland of drought-tolerant short grasses, forbs, and a few shrubs. Burro grass and mesquite have increased greatly in this part of the county.

Growth of native vegetation is greatest during May and June when rainfall and temperatures are favorable. Another growth period usually occurs in the fall during September and October. The more fertile soils on bottom lands produce some grasses that grow in the cool seasons as well as those that grow in the warm seasons. This is of particular value for year long forage. The success of the stockman depends largely upon how successfully he keeps the soil productive with good forage plants. This is done primarily by managing the time and intensity of grazing and by applying needed treatment practices to permit reestablishment of the natural plant community for each soil.

Engineering

DOUGLAS BARTOSH, engineer, Soil Conservation Service, assisted in preparing this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in tables in this section are based on test data and estimated data in the "Soil Properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to and hardness of bedrock within 5 or 6 feet of the surface, soil wetness characteristics, slope, likelihood of flooding, natural soil structure or aggregation, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to—(1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table 6 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 7, for sanitary facilities; and table 9, for water management. Table 8 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have different meanings in soil science and in engineering; many of the terms are defined in the Glossary.

Building Site Development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 6. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations

can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the soil wetness, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 6 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable so that cracking or subsidence from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity, and soil wetness were also considered. Soil wetness indicates potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 6 have an all-weather surface that can carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The AASHTO and Unified classifications of the soil and the soil texture, density, and shrink-swell potential, are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones, all of which affect stability and ease of excavation, were also considered.

Sanitary Facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that deal with the ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 7 shows the degree and kind of limitations of each soil for these uses and for use of the soil as daily cover for landfills.

If the degree of soil limitation is indicated by the rating *slight*, soils are favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance are required. The ratings "good," "fair," and "poor" used in the last column of the table, are approximately parallel to the ratings "slight," "moderate," and "severe."

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect the absorption of the effluent are permeability, depth to bedrock, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand or fractured bedrock at a depth less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that increase the size of the absorption field so that satisfactory performance is achieved.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor area surrounded by cut slopes or embankments of compacted,

nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that are very high in organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard. Slope, depth to bedrock, and susceptibility to flooding also affect the location of sites for sewage lagoons or the cost of construction., Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste either in excavated trenches or on the surface of the soil. The waste is spread, compacted in layers, and covered with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to bedrock, are free of large stones and boulders, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 7 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the trench type of landfill, ease of excavation also affects the suitability of a soil for this purpose, so the soil must be deep to bedrock and free of large stones and boulders.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for sanitary landfill should be soil that is easy to excavate and spread over the compacted fill during both wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

Construction Materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 8 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed and described as the survey is made, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soil are evaluated as sources of roadfill for low embankments, generally less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material after it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about soil properties that determine such performance is given in the descriptions of soil series.

The ratings apply to the soil profile between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within the profile. The estimated engineering properties in table 12 provide more specific information about the nature of each horizon that can help determine its suitability for roadfill.

According to the Unified soil classification system, soils rated *good* have low shrink-swell potential, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as high shrink-swell potential, steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*, regardless of the quality of the suitable material.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 12.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly

by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to sustain the growth of plants. Also considered is the damage that would result to the area from which the topsoil is taken.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones, are low in content of gravel and other coarse fragments, and have gentle slopes. They are low in soluble salts, which can limit plant growth. They are naturally fertile or respond well to fertilization. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils; very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is much preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter. Consequently, careful preservation and use of material from these horizons is desirable.

Water Management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 9 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitation are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the rated use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for this use have low seepage potential, which is determined by the permeability and depth over fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and is of favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness; depth to bedrock or other unfavorable material; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff at nonerosive velocities to outlets. Features that affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. Onsite assessment of height, duration, and frequency of flooding is essential in planning recreational facilities.

In table 10 the limitations of soils are rated as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by additional information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 7, and interpretations for dwellings without basements and for local roads and streets, given in table 6.

Camp areas require such site preparation as shaping and leveling tent and parking areas, stabilizing roads and

intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet nor subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and not wet nor subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over rock should be sufficient to allow necessary grading.

The design and layout of paths and trails for walking, horseback riding, and bicycling should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife Habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the development of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by properly managing the existing plant cover, and by fostering the natural establishment of desirable plants.

In table 11 the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in—

1. Planning the use of parks, wildlife refuges, nature study areas, and other developments for wildlife.
2. Selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat.
3. Determining the intensity of management needed for each element of the habitat.
4. Determining areas that are suitable for acquisition to manage for wildlife.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, grain sorghum, wheat, oats, barley, millet, buckwheat, cowpeas, soybeans, and sunflowers. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are tall fescue, bluegrass, lovegrass, switchgrass, bromegrass, timothy, orchardgrass, clover, alfalfa, trefoil, and crownvetch. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established herbaceous grasses and forbs, that provide food and cover for wildlife. Examples are bluestem, indiangrass, bristlegrass, goldenrod, beggarweed, bushsunflower, partridgepea, Engelmanndaisy, gaura, wheatgrass, and milkvetch. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Shrubs are bushy woody plants that produce fruits, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Examples are condalia, forestiera, fourwing saltbush, and sumac. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, and moisture.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of croplands, pastures, native grasslands, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, scaled quail, dove, meadowlark, field sparrow, killdeer, cottontail rabbit, red fox, and pronghorn antelope.

Rangeland habitat consists of wild herbaceous plants and shrubs on native grasslands. Examples of wildlife attracted to this habitat are antelope, white-tailed deer, jackrabbit, javelina, coyote, dove, scaled quail, wild turkey, meadowlark, and lark bunting.

Soil Properties

DOUGLAS BARTOSH, engineer, Soil Conservation Service, assisted in preparing the engineering sections.

Extensive data about soil properties collected during the soil survey are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

When he makes soil borings during field mapping, the soil scientist can identify several important soil properties. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness of the soil and its color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in-place under the existing soil moisture conditions. He records the root depth of existing plants, determines soil pH or reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and in physical and chemical properties for each major horizon of each soil in the survey area. Also, pertinent soil and water features and engineering test data are presented.

Engineering Properties

Table 12 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Information is presented for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a typical profile of each soil is indicated. More information about the range in depth and in properties of each horizon is given for each soil series in the section "Morphology of the Soils."

Texture is described in table 12 in standard terms used by the United States Department of Agriculture (*4*). These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials Soil Classification System (AASHTO). In table 12, soils in the survey area are classified according to both systems.

The Unified system (*2*) classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example CL-ML.

The AASHTO system (*1*) classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified as one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified as A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 15. The estimated classification, without group index numbers, is given in table 12. Also in table 12 the percentage, by weight, of cobbles or the rock fragments more than 3 inches in diameter are estimated for each major horizon. These

estimates are determined largely by observing volume percentage in the field and then converting it, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four standard sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistency of soil. These indexes are used in both the USCS and the AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior.

Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey. Liquid limit and plasticity index are defined in the Glossary.

Physical and Chemical Properties

Table 13 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships between the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the plannning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A *high* shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion, as used in table 13, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

Erosion factors are used in an equation that predicts the amount of soil loss resulting from rainfall erosion of cropland. The soil-loss prediction procedure is outlined by the U.S. Department of Agriculture, Agricultural Research Service (*5*), and is useful to guide the selection of practices for soil and water conservation. The soil erodibility factor "K" is a measure of the rate at which a soil will erode when other factors affecting erosion are constant. Soil-loss tolerance "T," sometimes called permissible soil loss, is the maximum rate of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely.

Wind erodibility groups are used to predict soil losses by wind. Soil properties that influence the susceptibility of a soil to significant wind erosion losses are texture, dry clod structure, carbonates, wetness, and stoniness. Also important are climatic factors, such as rainfall and wind velocity, and the mount of vegetative cover. These groupings are not only useful for predicting the susceptibility of a field to erosion but are also useful for defining the controls needed to reduce this susceptibility. The wind erodibility groups are defined in the Glossary.

Soil and Water Features

Features that relate to runoff or infiltration of water, to flooding, and to grading and excavation of each soil are indicated in table 14. This information is helpful in planning land uses and engineering projects that are likely to be affected by the amount of runoff from watersheds, by flooding, or by the presence of bedrock or a cemented pan in the upper 5 or 6 feet of the soil.

Hydrologic soil groups. Soils are placed in one of four groups on the basis of intake of water at the end of long-duration storms occurring after prior wetting and opportunity for swelling and without the protective effects of vegetation.

The major soil groups are:

A. (Low runoff potential). Soils having high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission and a low runoff potential.

B. Soils having moderate infiltration rates when thoroughly wetted. These consist chiefly of moderately deep to deep, moderately well drained to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

C. Soils having slow infiltration rates when thoroughly wetted. These consist chiefly of soils with a layer that impedes downward movement of water or soils with moderately fine to fine texture. These soils have a slow rate of water transmission.

D. (High runoff potential). Soils having very slow infiltration rates when thoroughly wetted. These consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is rated in general terms that describe the frequency, duration, and period of the year when flooding is most likely. The ratings are based on evidences in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; absence of distinctive soil horizons that form in soils of the area that are not subject to flooding; local information about floodwater heights and the extent of flooding; and local knowledge that relates the unique landscape position of each soil to historic floods.

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is shown for all soils that are underlain by bedrock at depths of 5 to 6 feet or less. For many soils, limited ranges in depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and other observations during the soil mapping. The kind of bedrock and its relative hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200 horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers that are strongly compacted (indurated). Such pans cause difficulty in excavation. Hardness of pans is defined the same as hardness of bedrock.

Engineering Test Data

Table 15 contains the results of engineering tests performed by the Texas Highway Department on some of the soils of Glasscock County. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

As moisture is removed, the soil shrinks and decreases in volume in direct proportion to the loss in moisture until a condition of equilibrium, called the shrinkage limit, is reached. At this point, shrinkage stops, although additional moisture is removed. Shrinkage limit is reported as the percentage of moisture in ovendry soil.

Linear shrinkage is the decrease in one dimension of the soil mass that occurs when the moisture content is reduced from the liquid limit to the shrinkage limit. It is expressed as a percentage of the original dimension.

Shrinkage ratio is the volume change that results from the drying of soil material divided by the moisture loss caused by drying. It is expressed numerically.

Mechanical analysis shows the percentages, by weight, of soil particles that pass sieves of specified sizes. Sand and other coarser materials do not pass the No. 200 sieve, as do the finer silt and clay particles.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from solid to plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Classification of the soils in the AASHTO and Unified systems of classification are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits.

Formation, Classification, and Morphology of the Soils

In this section the factors of soil formation are discussed and related to the formation of soils in Glasscock County. Also, the current system of soil classification is explained, and the soils in the county are placed in some categories of the system. Then, the morphology for each of the soil series in the county is given.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agen-

cies. The characteristics of the soil at any given point are determined by (1) the physical and mineral composition of the parent materials; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are active factors of soil genesis. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. It may be much or little, but some time is always required for horizon differentiation. Usually a long time is required for the development of distinct horizons.

The factors of soil genesis are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four.

Parent Material

Parent material refers to the unconsolidated mass from which the soil develops. The soils of Glasscock County have developed in residual, outwash, and alluvial deposits.

The soils of the Edwards Plateau in the northeastern, eastern, central, southwestern, and southern parts of the county have developed from the weathering of residual limestone and from old valley fill outwash materials. They began forming in the Cretaceous period. The soils of the Edwards Plateau range from shallow to very shallow soils on the steep slopes, where erosion has kept pace with soil development, to deep soils on the high flats and divides. The major shallow and very shallow soils are Conger, Mereta, and Ector soils. The major moderately deep and deep soils are Tobosa, Angelo, and Reagan soils. The shallow soils are underlain at varying depths by caliche, caliche coated limestone, or limestone.

The soils on the High Plains in the northwestern part of the county have developed from Quaternary materials that are commonly called Rocky Mountain outwash. The parent materials of these soils are largely alkaline and calcareous; unconsolidated; and sandy, clayey, and silty. This outwash material may have been reworked by wind or affected by a fluctuating water table many times since it was first deposited. The major soils in this area are Amarillo, Patricia, and Midessa soils.

The alluvial soils of the county are very young. They are Bippus and Rioconcho. These soils occur on the flood plains of the major creeks and rivers.

Climate

Climate has had a definite effect on the development of the soils in Glasscock County. Precipitation, temperature, and wind are some of the influencing factors of climate.

The wet climate of past geological ages influenced the deposition of the parent materials. Later, as the soils began to develop, the climate became subhumid. The limited rainfall was not enough to leach the minerals from the soils. As a result, except for the sandy soils, most of the soils are high in fertility. The soils seldom get wet to a depth of more than 6 feet. Consequently, many soils have a horizon of calcium carbonate a few feet below the surface. Most of the young soils have lime throughout the profile.

Summer temperatures are high and winter temperatures are mild. The high temperatures and low rainfall have limited the accumulation of organic matter in the soils.

Plant and Animal Life

Plants, animals, insects, and bacteria are important in the formation of soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are among the changes caused by living organisms.

Amount and type of vegetation, dominantly grasses, has affected soil formation in Glasscock County more than other living organisms.

Relief

Relief influences soil development through its effect on drainage and runoff. The degree of profile development depends mainly on the average amount of moisture in the soil if other factors are equal. Nearly level soils absorb more moisture and ordinarily have better developed profiles than steeper soils. Furthermore, many of the steeper soils erode almost as fast as they form.

Relief also effects the kind and amount of vegetation on a soil. Slopes facing north and east receive less direct sunlight than those facing south and west; consequently, they lose less moisture through evaporation. As a result, the vegetation is denser on slopes facing north and east.

Soils that are nearly level or slightly concave are likely to have a darker color than sloping soils because they receive more moisture and produce more vegetation; consequently, they contain more organic matter, which imparts a darker color.

Time

Time is required for the formation of soils that have distinct horizons. The differences in length of time that parent materials have been in place, therefore, are commonly reflected in the degree of development of the soil profile.

The soils in Glasscock County range from young to old. The young soils have very little profile development, and the older soils have well expressed soil horizons.

The bottom land soils are an example of young soils lacking development. Time is important in the development of these soils.

Nearly level to gently sloping soils that have been in place for long periods normally show the greatest profile development. In Glasscock County, examples of these soils are Amarillo and Acuff soils. Time is also important in the development of these soils.

Many shallow soils on steep slopes have been in the process of development as long as the well-developed, nearly level soils. Geologic erosion has removed the effects of soil formation on the shallow soils, and such soils have not reached an equilibrium with their environment. Here, relief is the dominant soil-forming factor rather than time. The Conger and Ector soils are examples.

Classification of the Soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available. See the unpublished working document "Soil Taxonomy, a basic system of soil classification for making and interpreting soil surveys," 1973, available in the SCS State Office, Temple, Texas.

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the bases for classification are the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 16 the soils of the survey area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and that are important to plant growth or that were selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Paleustolls (*Pale*, meaning horizons that have more than normal development, plus *ustoll*, the suborder of Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group is divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Aridic Paleustolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, thermic, Aridic Paleustolls.

SERIES. The series consists of a group of soils that are formed from a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition. An example is the Acuff series, a member of the fine-loamy, mixed, thermic, family of Aridic Paleustolls.

Morphology of the Soils

On the following pages each soil series in the survey area is described in detail. The series descriptions are presented in alphabetic order by series name.

For each series, some facts about the soil and its parent material are presented first. Then a pedon, a small three-dimensional area of soil typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*4*). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series mapped in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil Maps for Detailed Planning."

Acuff Series

The Acuff series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy sediment that has been modified by wind. Slope ranges from 0 to 1 percent.

Typical pedon of Acuff loam, 0 to 1 percent slopes, in range; from the intersection of Texas Highway 158 and Ranch Road 33 in Garden City, 14.6 miles north on Ranch

Road 33, 3.0 miles west on Farm Road 461, 0.75 mile south on a county road, and 1,850 feet east:

A1—0 to 8 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; hard, friable, slightly sticky; many fine roots; many fine pores; noncalcareous; neutral; clear smooth boundary.

B21t—8 to 16 inches; reddish brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; few fine roots; many fine pores; few discontinuous clay films on ped faces; noncalcareous; mildly alkaline; gradual smooth boundary.

B22t—16 to 23 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; few fine roots; many fine pores; nearly continuous clay films on prism faces and patchy clay films on ped faces; few films of calcium carbonate in lower part; noncalcareous; mildly alkaline; gradual wavy boundary.

B23t—23 to 45 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; thin discontinuous clay films on prism faces and ped faces; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B24tca—45 to 66 inches; reddish yellow (5YR 7/6) sandy clay loam, reddish yellow (5YR 6/6) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; many soft masses and weakly cemented concretions of calcium carbonate comprising an estimated 43 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

B25tca—66 to 80 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; many soft masses and weakly cemented concretions of calcium carbonate comprising an estimated 20 percent by volume; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Thickness of the mollic epipedon ranges from 11 to 18 inches. The mollic epipedon commonly includes all of the A horizon and the upper part of the B2t horizon. Depth to layers containing secondary calcium carbonate ranges from 16 to 32 inches.

The A horizon ranges from 8 to 10 inches in thickness. It is reddish brown, brown, dark brown, or dark grayish brown. It is neutral or mildly alkaline.

The B2t horizon is sandy clay loam, clay loam, or loam, with clay content of 25 to 35 percent. It is mildly alkaline or moderately alkaline. The B2t horizon above the calcic horizon is reddish brown, red, yellowish red, reddish yellow, light brown, or brown. The B2tca horizon is pink, light reddish brown, light brown, or reddish yellow. Calcium carbonate content in the B2tca horizon ranges from 20 to 45 percent, by volume.

Amarillo Series

The Amarillo series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy eolian deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Amarillo fine sandy loam, 1 to 3 percent slopes, in range; from the intersection of Texas Highway 158 and Ranch Road 33 in Garden City, 10.5 miles north on Ranch Road 33, 6.0 miles west on a county road, 1.0 mile south, 1.0 mile west, 1.0 mile north, 0.4 mile west, 7.2 miles north, 0.52 mile west, and 900 feet south:

A1—0 to 8 inches; brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak fine granular structure; hard, friable, nonsticky; many roots; many pores; noncalcareous; neutral; clear smooth boundary.

B21t—8 to 18 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic parting to weak fine and medium subangular blocky structure; hard, friable, slightly sticky; common roots; many pores; thin discontiuous clay films on prism faces and patchy clay films on peds; noncalcareous; mildly alkaline; clear smooth boundary.

B22t—18 to 34 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; few roots; common pores; nearly continuous clay films on prism faces and patchy clay films on peds; noncalcareous; mildly alkaline; gradual smooth boundary.

B23t—34 to 52 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic parting to weak fine to medium subangular blocky structure; hard, friable, slightly sticky; common pores; few films and threads of calcium carbonate; few patchy clay films on peds; calcareous; moderately alkaline; gradual wavy boundary.

B24tca—52 to 64 inches; pink (5YR 8/4) sandy clay loam, pink (5YR 7/4) moist; weak coarse prismatic parting to weak fine subangular blocky structure; hard, friable, slightly sticky; many soft masses and weakly cemented concretions of calcium carbonate comprising about 30 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

B25t—64 to 80 inches; reddish yellow (5YR 7/6) sandy clay loam, reddish yellow (5YR 6/6) moist; weak fine subangular blocky structure; hard, friable, slightly sticky; few patchy clay films and sand grains bridged with clay films; many soft masses and weakly cemented concretions of calcium carbonate comprising an estimated 20 percent by volume; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to the calcic horizon ranges from 30 to 60 inches.

The A horizon ranges from 7 to 15 inches in thickness. It is reddish brown or brown. It is neutral or mildly alkaline.

The B2t horizon is sandy clay loam or clay loam. It is mildly alkaline or moderately alkaline. The B2t horizon above the calcic horizon is reddish brown, brown, yellowish red, or reddish yellow. The B2tca horizon is pink, light brown, light reddish brown, or reddish yellow. Soft masses and weakly cemented concretions of calcium carbonate ranges from 20 to 50 percent by volume of the B2tca horizon. The B2t horizon below the calcic horizon is reddish brown, reddish yellow, yellowish red, or red.

Some pedons lack a calcic horizon within a depth of 60 inches. There is no difference in behavior, use, or management.

Angelo Series

The Angelo series consists of deep, loamy soils on uplands. These soils formed in calcareous, clayey sediment, mainly of ancient stream terraces. Slope ranges from 0 to 3 percent.

Typical pedon of Angelo silty clay loam, 0 to 1 percent slopes, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 7.4 miles southeast on Texas Highway 158, then 2.0 miles north on a county road, and 20 feet west:

A11—0 to 8 inches; dark brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium granular structure; hard, friable, sticky; common roots; common pores; calcareous; moderately alkaline; clear smooth boundary.

A12—8 to 16 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; hard, firm, sticky; few roots; few vertical dark streaks same color as A11 horizon; these streaks are 1/2-inch wide; calcareous; moderately alkaline; gradual smooth boundary.

B21—16 to 26 inches; reddish brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; moderate fine and medium blocky structure; hard, firm, sticky; shiny ped faces; calcareous; moderately alkaline; gradual smooth boundary.

B22—26 to 34 inches; reddish brown (5YR 5/4) silty clay, reddish brown (5YR 4/4) moist; moderate fine and medium blocky structure; hard, firm, sticky; few visible soft masses and weakly cemented concretions of calcium carbonate comprising about 1 to 2 percent by volume; calcareous; moderately alkaline; gradual wavy boundary.

B23ca—34 to 47 inches; pink (5YR 8/4) silty clay, pink (5YR 7/4) moist; weak medium subangular blocky structure; hard, friable, sticky; many soft visible masses and weakly cemented concretions of calcium carbonate comprising 25 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

B24ca—47 to 80 inches; reddish yellow (5YR 7/6) silty clay, reddish yellow (5YR 6/6) moist; weak medium subangular blocky structure; hard, friable, sticky; common visible soft masses and weakly cemented concretions of calcium carbonate comprising about 15 percent by volume; inside of peds are red; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. It is moderately alkaline throughout. Depth to the calcic horizon ranges from 24 to 39 inches.

The A horizon ranges from 10 to 19 inches in thickness. It is brown, dark brown, grayish brown, reddish brown, or dark grayish brown. The A12 horizon is clay loam, silty clay loam, clay, or silty clay.

The B2 horizons are clay loam, silty clay loam, clay, or silty clay with clay content of 35 to 55 percent. The B2 horizon above the calcic horizon is reddish brown or brown. The B2ca horizon is pink, reddish yellow, or yellowish red. Soft masses and weakly cemented concretions of calcium carbonate comprise 15 to 55 percent, by volume, of the B2ca horizon.

Arvana Series

The Arvana series consists of moderately deep, loamy soils on uplands. These soils formed in thick accumulations of loamy caliche that is indurated in the upper part. Slope ranges from 1 to 3 percent.

Typical pedon of Arvana fine sandy loam, 1 to 3 percent slopes, in range; from the intersection of Texas Highway 158 and Ranch Road 33 in Garden City, 10.5 miles north on Ranch Road 33, 6.0 miles west on a county road, 1.0 mile south, 1.0 mile west, 1.0 mile north, 0.4 mile west, 7.2 miles north, 3.0 miles west, and 125 feet northeast:

A1—0 to 9 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; hard, very friable, nonsticky; many very fine roots; many fine pores; neutral; clear smooth boundary.

B21t—9 to 20 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky structure; hard, friable, slightly sticky; common fine roots; many fine pores; nearly continuous clay films on prism faces and patchy clay films on ped faces; noncalcareous; neutral; gradual smooth boundary.

B22t—20 to 28 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; many fine pores; nearly continuous clay films on prism faces and patchy clay films on ped faces; noncalcareous; mildly alkaline; abrupt wavy boundary.

B23cam—28 to 40 inches; pinkish white (5YR 8/2) indurated plates of caliche with a laminar upper surface layer 1/8-inch thick; calcareous; moderately alkaline; gradual wavy boundary.

B24ca—40 to 70 inches; pinkish white (5YR 8/2) loam, pinkish gray (5YR 7/2) moist; weak fine subangular blocky structure; hard, friable; about 70 percent calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum or depth to the B2cam horizon ranges from 20 to 36 inches.

The A horizon ranges from 6 to 12 inches in thickness. It is reddish brown or brown. It is neutral through moderately alkaline.

The B2t horizon is sandy clay loam, clay loam, loam, or fine sandy loam, with clay content of 18 to 35 percent. It is reddish brown, yellowish red, or red. It is neutral to moderately alkaline.

The B2cam horizon ranges from 6 to 18 inches in thickness. It is indurated to strongly cemented caliche.

The B2ca horizon is loam, clay loam, or sandy clay loam. It contains 45 to 70 percent, by volume, calcium carbonate. It is white, pink, or pinkish white.

Bippus Series

The Bippus series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy sediment on outwash fans and in colluvial valley fill. Slope ranges from 0 to 1 percent.

Typical pedon of Bippus clay loam, 0 to 1 percent slopes, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 13.2 miles west on Texas Highway 158, 5.9 miles south on Texas Highway 137, 1.8 miles west on a county road, 0.4 mile north on oil field road, and 25 feet west:

A11—0 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; hard, friable, sticky; many roots; many fine pores; calcareous; moderately alkaline; gradual smooth boundary.

A12—12 to 24 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak coarse prismatic parting to moderate fine and medium subangular blocky structure; hard, friable, sticky; many roots; many fine pores; many wormcasts; calcareous; moderately alkaline; gradual smooth boundary.

B21b—24 to 56 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic parting to moderate fine and medium subangular blocky structure; hard, friable, sticky; common roots; many pores; few very fine weakly cemented concretions and films and threads of calcium carbonate comprising about 2 percent by volume; calcareous; moderately alkaline; gradual smooth boundary.

B22b—56 to 62 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; hard, friable, sticky; few very fine weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 50 to more than 62 inches in thickness. Thickness of the mollic epipedon ranges from 22 to 28 inches.

The A horizon ranges from 16 to 32 inches in thickness. It is dark grayish brown, very dark grayish brown, dark brown, grayish brown, or brown. It is mildly alkaline or moderately alkaline.

The B2b horizon is clay loam, sandy clay loam, or loam with clay content of 20 to 35 percent in the control section. The B21b horizon is brown, dark brown, grayish brown, or dark grayish brown. The B22b horizon is reddish brown, light brown, brown, or yellowish red.

Blakeney Series

The Blakeney series consists of shallow, loamy soils on uplands. These soils formed in loamy caliche materials that are indurated in the upper part. Slope ranges from 1 to 3 percent.

Typical pedon of Blakeney fine sandy loam, 1 to 3 percent slopes, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 13.2 miles west on Texas Highway 158, 5.9 miles south on Texas Highway 137, 5.25 miles west on county road, and 530 feet north:

A1—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular and weak fine subangular

blocky structure; slightly hard, friable, slightly sticky; many fine roots; many fine pores; calcareous; moderately alkaline; gradual smooth boundary.

B2—5 to 13 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; hard, friable, slightly sticky; common fine roots; many fine pores; few weakly cemented concretions of visible calcium carbonate comprising less than 2 percent by volume; calcareous; moderately alkaline; clear smooth boundary.

Ccam—13 to 35 inches; whitish indurated caliche in broken layers 1 to 4 inches thick; laminar in upper 1/4 inches; calcareous; moderately alkaline; gradual wavy boundary.

Cca—35 to 60 inches; pinkish white (7.5YR 8/2) loamy earth of about clay loam texture; platy; weakly cemented caliche; calcareous; moderately alkaline.

The solum ranges from 12 to 18 inches in thickness.

The A horizon ranges from 5 to 8 inches in thickness. It is brown, pale brown, pinkish gray, light brownish gray, or grayish brown.

The B2 horizon is loam or fine sandy loam with clay content of 10 to 18 percent. It is brown, pale brown, light brown, or pinkish gray.

The Ccam horizon ranges from 16 to 30 inches in thickness. It is indurated to strongly cemented caliche.

The Cca horizon is loam or clay loam earth that is weakly to strongly cemented. It is white, pink, or pinkish white.

Broome Series

The Broome series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy sediment of outwash and eolian origin. Slope ranges from 1 to 3 percent.

Typical pedon of Broome clay loam, 1 to 3 percent slopes, in range; from the Sterling-Glasscock County line marker on U.S. Highway 87, 2.47 miles northwest on U.S. Highway 87, and 70 feet west:

A1—0 to 7 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak fine granular and weak fine and medium subangular blocky structure; hard, friable, slightly sticky; many fine roots; many fine pores; calcareous; moderately alkaline; clear smooth boundary.

B21tca—7 to 19 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; few fine roots; many pores; common films, threads, and fine concretions of calcium carbonate comprising about 16 percent by volume; calcareous; moderately alkaline; clear wavy boundary.

B22tca—19 to 36 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; many soft masses and weakly cemented concretions of calcium carbonate comprising about 29 percent by volume; calcareous; moderately alkaline; gradual wavy boundary.

B23tca—36 to 70 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic parting to weak and moderate medium subangular blocky structure; hard, firm, sticky; patchy clay films; many soft masses and weakly cemented concretions of calcium carbonate comprising about 28 percent by volume; calcareous; moderately alkaline.

The solum ranges from 60 to more than 70 inches in thickness. It is moderately alkaline throughout. Depth to the calcic horizon ranges from 6 to 9 inches.

The A horizon is reddish brown, dark brown, brown, or pinkish gray. When moist values and chromas are less than 3.5, the A horizon is less than 7 inches thick.

The B2tca horizon is clay loam or silty clay loam with clay content of 22 to 35 percent. Calcium carbonate comprises 5 to 50 percent, by volume, of these horizons. The B2tca horizon is reddish brown, light reddish brown, light brown, brown, yellowish red, reddish yellow, or pink.

Conger Series

The Conger series consists of shallow, loamy soils on uplands. These soils formed in calcareous, loamy materials, the upper part of which is indurated caliche. Slope ranges from 1 to 5 percent.

Typical pedon of Conger clay loam, 1 to 5 percent slopes, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 1.4 miles west on Texas Highway 158, 1.0 mile south on a county road, 0.4 mile west, and 75 feet south:

A1—0 to 5 inches; brown (7.5YR 5/2) clay loam, brown (7.5YR 4/2) moist; weak fine granular and weak fine subangular blocky structure; slightly hard, friable, slightly sticky; many fine roots; many fine pores; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B2—5 to 18 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky; common fine roots; many fine pores; few films, threads, and fine to medium concretions of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

Ccam—18 to 35 inches; whitish indurated caliche in broken layers 1 to 4 inches thick; laminar in upper 1/4 inch; calcareous; moderately alkaline; gradual wavy boundary.

Cca—35 to 60 inches; pinkish white (5YR 8/2) loamy earth of about clay loam texture; platy; weakly cemented caliche; calcareous; moderately alkaline.

The solum ranges from 12 to 20 inches thick. It is moderately alkaline throughout.

The A horizon ranges from 4 to 6 inches in thickness. It is brown or grayish brown.

The B2 horizon is loam or clay loam. It is pale brown, light brown, or brown.

The Ccam horizon ranges from 12 to 24 inches in thickness. It is indurated to strongly cemented caliche.

The Cca horizon is loam or clay loam earth that is weakly to strongly cemented. It is white, pink, or pinkish white.

Cottonwood Series

The Cottonwood series consists of very shallow, loamy soils on uplands. These soils formed in materials weathered from impure gypsum. Slope ranges from 1 to 8 percent.

Typical pedon of Cottonwood loam in an area of Cottonwood association, undulating, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 13.2 miles west on Texas Highway 158, 3.6 miles north on Texas Highway 137, and 50 feet east:

A11—0 to 3 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, friable, nonsticky; common roots; many pores; calcareous; moderately alkaline; clear smooth boundary.

A12—3 to 7 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, friable, nonsticky; few fine roots; common pores; calcareous; moderately alkaline; abrupt wavy boundary.

C—7 to 20 inches; white (10YR 8/2) soft chalky gypsum that becomes harder with depth; no evidence of roots; calcareous; moderately alkaline.

The solum ranges from 3 to 12 inches in thickness.

The A horizon is brown, grayish brown, light gray, light brownish gray, or pinkish gray.

The C horizon is weakly to strongly consolidated chalky gypsum.

In some pedons, the solum is slightly thicker than 12 inches over gypsum.

Ector Series

The Ector series consists of shallow or very shallow, loamy soils on uplands. These soils formed in limestone deposits on plateaus and erosional landscapes. Slope ranges from 1 to 40 percent.

Typical pedon of Ector gravelly clay loam in an area of Ector association, undulating, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 7.4 miles southeast on Texas Highway 158, 3.7 miles north on a county road, 0.57 mile north on oilfield road, and 25 feet east:

A1—0 to 9 inches; dark brown (10YR 4/3) gravelly clay loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky; common fine roots; many limestone fragments about 1 to 4 inches in diameter comprising about 50 percent by volume; the limestone fragments in the lower half of the horizon are coated with secondary carbonates on the lower side; calcareous; moderately alkaline; abrupt irregular boundary.

R&Cca—9 to 19 inches; fractured hard limestone with hardness of about 4 Mohs' scale; coatings of calcium carbonate on surface; cracks and fractures are filled and partly sealed with reprecipitated calcium carbonate; gradual wavy boundary.

R—19 to 40 inches; fractured limestone bedrock; few seams of calcium carbonate in partings in upper part.

Thickness of the solum or depth to the limestone bedrock ranges from 4 to 20 inches.

The A horizon is brown, dark brown, dark grayish brown, or very dark grayish brown. Limestone fragments comprise 35 to 75 percent, by volume, of the A horizon.

The R&Cca horizon ranges from 6 to 12 inches in thickness.

The R layer is several feet thick.

Estacado Series

The Estacado series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy, eolian sediment. Slope ranges from 0 to 1 percent.

Typical pedon of Estacado clay loam, 0 to 1 percent slopes, in a cultivated field; from the intersection of Texas Highway 158 and Ranch Road 33 in Garden City, 14.6 miles north on Ranch Road 33, 1.27 miles west on Farm Road 461, and 4,170 feet north:

Ap—0 to 8 inches; brown (7.5YR 4/3) clay loam, dark brown (7.5YR 3/3) moist; weak fine granular and subangular blocky structure; hard, friable, slightly sticky; few fine pores; calcareous; moderately alkaline; abrupt smooth boundary.

A1—8 to 16 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak coarse prismatic parting to weak fine subangular blocky structure; hard, friable, sticky; many fine pores; many wormcasts; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21tca—16 to 25 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic parting to weak fine and medium subangular blocky structure; hard, friable, sticky; many fine pores; common wormcasts; few patchy clay films; few films, threads, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22tca—25 to 36 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic parting to weak fine to medium subangular blocky structure; hard, friable, sticky; many fine pores; few wormcasts; few patchy clay films; common films, threads, soft masses, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B23tca—36 to 60 inches; pink (5YR 8/4) clay loam, pink (5YR 7/4) moist; weak coarse prismatic parting to weak fine subangular blocky structure; hard, friable, sticky; many soft masses and weakly cemented concretions of calcium carbonate comprising about 45 percent by volume; calcareous; moderately alkaline; diffuse boundary.

B24tca—60 to 80 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; weak coarse prismatic parting to weak fine subangular blocky structure; hard, friable, sticky; few patchy clay films; many soft masses and weakly cemented concretions of calcium carbonate comprising about 30 percent by volume; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. It is moderately alkaline throughout. Depth to the calcic horizon ranges from 13 to 19 inches.

The A horizon is brown, dark brown, or dark grayish brown.

The B2tca horizon is clay loam or sandy clay loam with clay content of 18 to 28 percent. Calcium carbonate comprises 5 to 50 percent, by volume, of this horizon. The B2tca horizon is brown, light brown, light reddish brown, reddish yellow, or pink.

Lipan Series

The Lipan series consists of deep, clayey soils that occupy the bottoms of enclosed depressions or intermittent lakes (playas). These soils formed in calcareous, clayey sediment. They crack when dry and have gilgai microrelief. Some areas are stony. Slope ranges from 0 to 1 percent.

Typical pedon of Lipan clay, depressional, at the center of a microdepression, in range; from the intersection of Texas Highway 158 and Ranch Road 33 in Garden City, 7.5 miles south on Ranch Road 33, and 530 feet east:

A1—0 to 22 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine and medium blocky structure; very hard, very firm, very sticky and plastic; many roots in upper 10 inches; peds have shiny pressure faces; calcareous; moderately alkaline; gradual smooth boundary.

AC—22 to 55 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few very fine roots; few slickensides; shiny pressure faces on peds; few very fine concretions of calcium carbonate comprising 1 percent by volume; calcareous; moderately alkaline; gradual wavy boundary.

Cca—55 to 70 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; massive; very hard, very firm, very sticky and plastic; few to common soft masses and concretions of calcium carbonate comprising 2 to 4 percent by volume; calcareous; moderately alkaline.

The solum ranges from 40 to 63 inches thick. It is mildly alkaline or moderately alkaline.

In undisturbed areas, gilgai microrelief consists of microknolls that are 6 to 24 inches higher than the microdepressions. Distance between the center of the microknolls and the center of the microdepressions is 3 to 20 feet. When the soil is dry, cracks 1 to 2 inches wide extend from the surface into the AC horizon. Intersecting slickensides begin at depths of about 20 to 30 inches.

The A horizon ranges from 14 to 23 inches in thickness. It is gray or dark gray.

The AC horizon is clay or silty clay with clay contents of 40 to 60 percent. It is gray, grayish brown, or light brownish gray.

The Cca horizon is gray, light brownish gray, brown, or pale brown. Calcium carbonate comprises 2 to 35 percent, by volume, of the Cca horizon.

The pedons, in some areas, have about 25 to 30 percent loose limestone fragments on the surface and throughout the solum. Limestone fragments are of cobble and stone size, ranging from 3 inches to 4 feet or more across.

Mereta Series

The Mereta series consists of shallow, loamy soils on uplands. These soils formed in loamy caliche that is indurated in the upper part. Slope ranges from 1 to 3 percent.

Typical pedon of Mereta clay loam, 1 to 3 percent slopes, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 7.4 miles southeast on Texas Highway 158, 7.5 miles north and east on a county road, and 40 feet southeast:

A11—0 to 7 inches; dark brown (7.5YR 4/3) clay loam, dark brown (7.5YR 3/3) moist; weak fine granular and weak fine subangular blocky structure; hard, friable, sticky; many fine roots; many fine pores; few caliche fragments; calcareous; moderately alkaline; clear smooth boundary.

A12—7 to 17 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable, sticky; common fine roots; common fine pores; few caliche fragments in lower part; calcareous; moderately alkaline; abrupt wavy boundary.

C1cam—17 to 35 inches; whitish indurated caliche in broken layers 1 to 4 inches thick; gradual wavy boundary.

C2ca—35 to 60 inches; pink (5YR 8/4) limy earth of about clay loam texture; platy; weakly cemented caliche; calcareous; moderately alkaline.

Thickness of the solum or depth to the C1cam horizon ranges from 14 to 20 inches. The solum is moderately alkaline throughout.

The A horizon contains 35 to 45 percent clay. It is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown.

The C1cam horizon ranges from 8 to 25 inches in thickness. It is indurated to strongly cemented caliche. It is white or pinkish white.

The C2ca horizon is loam or clay loam earth that contains weakly cemented to strongly cemented caliche. It is white, pink, pinkish white, or pinkish gray.

Midessa Series

The Midessa series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy outwash and eolian deposits. Slope ranges from 0 to 5 percent.

Typical pedon of Midessa fine sandy loam, 0 to 1 percent slopes, in range; from the intersection of Texas Highway 158 and Ranch Road 33 in Garden City, 10.5 miles north on Ranch Road 33, 6.0 miles west on a county road, 1.0 mile south, 1.0 mile west, 1.0 mile north, 0.4 mile west, 5.2 miles north, 3.0 miles west, 1.0 mile north, and 800 feet west:

A1—0 to 9 inches; brown (7.5YR 5/3) fine sandy loam, dark brown (7.5YR 4/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky; many roots; many pores; calcareous; moderately alkaline; clear smooth boundary.

B21—9 to 19 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic parting to weak fine subangular blocky structure; slightly hard, very friable, slightly sticky; many pores; few visible films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—19 to 34 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic parting to weak fine subangular blocky structure; slightly hard, very friable, slightly sticky; common pores; few visible films, threads, and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B23ca—34 to 58 inches; pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; weak fine subangular blocky structure; hard, friable, sticky; many soft masses and weakly cemented concretions of calcium carbonate comprising about 45 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

C—58 to 80 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; massive; hard, friable, sticky; many soft masses and weakly cemented concretions of calcium carbonate comprising about 25 percent by volume; calcareous; moderately alkaline.

The solum ranges from 40 to 74 inches in thickness. It is moderately alkaline throughout. Depth to the calcic horizon ranges from 20 to 40 inches.

The A horizon ranges from 7 to 12 inches in thickness. It is brown, light brown, pale brown, or grayish brown.

The B2 horizon is loam, sandy clay loam, or clay loam with clay content of 20 to 35 percent. It is brown, light brown, pale brown, grayish brown, or light brownish gray.

The B23ca horizon is sandy clay loam or clay loam. It is pink, light brown, very pale brown, or pinkish white. Calcium carbonate comprises 15 to 50 percent, by volume, of this horizon.

The C horizon is loam, sandy clay loam, or clay loam. It is pink, light reddish brown, or light brown.

Monahans Series

The Monahans series consists of deep, loamy soils on uplands. These soils formed in calcareous and gypsiferous, loamy, old outwash and basin deposits. Slope ranges from 1 to 5 percent.

Typical pedon of Monahans fine sandy loam, 1 to 5 percent slopes, in range; from the Midland-Glasscock County line marker on Texas Highway 158, 0.36 mile southeast on Texas Highway 158, and 950 feet south:

A1—0 to 6 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky; many roots; many pores; calcareous; moderately alkaline; clear smooth boundary.

B2—6 to 17 inches; very pale brown (10YR 7.3) loam, pale brown (10YR 6/3) moist; weak coarse prismatic parting to weak fine granular and subangular blocky structure; slightly hard, very friable, nonsticky; many roots; many pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C1cacs—17 to 36 inches; pink (7.5YR 8/4) loam, pink (7.5YR 7/4) moist; massive; slightly hard, very friable, nonsticky; many visible threads and soft masses of calcium carbonate and gypsum material comprising about 40 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

C2cacs—36 to 60 inches; pink (7.5YR 7/4) loam, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable, nonsticky; contains less visible calcium carbonate than horizon above, but gypsum material remains about the same; calcareous; moderately alkaline.

Thickness of the solum or depth to the Ccacs horizon ranges from 11 to 18 inches. It is moderately alkaline throughout.

The A horizon ranges from 4 to 8 inches in thickness. It is light brown, brown, pale brown, or light yellowish brown.

The B2 horizon ranges from 5 to 11 inches in thickness. It is loam, fine sandy loam, or sandy clay loam with 18 to 30 percent clay in the control section. It is light brown, pale brown, very pale brown, or pink.

The Ccacs horizon is pale brown, very pale brown, pink, or pinkish gray. Visible calcium carbonate and gypsum material comprise 20 to 50 percent, by volume, of the Ccacs horizon.

These soils are considered to be a taxadjunct to the Monahans series because they are dry for shorter periods than those of the established Monahans series. The interpretations for these soils fit the Monahans series.

Patricia Series

The Patricia series consists of deep, sandy soils on uplands. These soils formed in loamy sediment of outwash and eolian origin. Slope ranges from 0 to 3 percent.

Typical pedon of Patricia loamy fine sand, 0 to 3 percent slopes, in range; from the intersection of Ranch Road 33 and Texas Highwasy 158 in Garden City, 13.2 miles west on Texas Highway 158, 7.65 miles north on Texas Highway 137, and 1.44 miles east:

A1—0 to 14 inches; reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; weak fine granular structure; hard, friable, nonsticky; many fine roots; many pores; noncalcareous; neutral; clear smooth boundary.

B21t—14 to 24 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky; many roots; many pores; nearly continuous clay films on prism faces; discontinuous clay films on ped faces; noncalcareous; neutral; gradual smooth boundary.

B22t—24 to 46 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak coarse prismatic parting to moderate fine and medium subangular blocky structure; hard, friable, slightly sticky; common roots; many pores; nearly continuous clay films on prism faces; discontinuous clay films on peds; noncalcareous; neutral; gradual smooth boundary.

B23t—46 to 64 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; weak coarse prismatic parting to moderate fine and medium subangular blocky structure; hard, friable, slightly sticky; common pores; nearly continuous clay films on prism faces; discontinuous clay films on peds; noncalcareous; mildly alkaline; gradual smooth boundary.

B24t—64 to 80 inches; reddish yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; weak coarse prismatic parting to weak fine subangular blocky structure; hard, friable, slightly sticky; discontinuous clay films on ped faces; few films and soft masses of calcium carbonate; noncalcareous; mildly alkaline.

The solum ranges from 60 to more than 80 inches thick.

The A horizon ranges from 9 to 20 inches in thickness. It is light brown, brown, or reddish brown. It is neutral or mildly alkaline.

The B2t horizon is red, yellowish red, reddish yellow, or reddish brown. It is sandy clay loam with clay contents of 20 to 35 percent. It is neutral through moderately alkaline.

When a calcic horizon occurs, it is below 60 inches.

Potter Series

The Potter series consists of very shallow, loamy soils on uplands. These soils formed in calcareous, loamy caliche beds. Slope ranges from 3 to 8 percent.

Typical pedon of Potter loam in an area of Potter soils, 3 to 8 percent slopes, in range; from the intersection of Texas Highway 158 and Ranch Road 33 in Garden City, 10.5 miles north on Ranch Road 33, 6.0 miles west on a county road, 1.0 mile south, 1.0 mile west, 1.0 mile north, 0.4 mile west, 7.2 miles north, 7.0 miles west, and 530 feet south:

A1—0 to 7 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky; many fine roots; common soft masses and weakly cemented concretions less than 2 mm in diameter of calcium carbonate that has a weight average of 20 percent; common to many calcium carbonate concretions from 2 to 5 mm in diameter comprising about 20 percent by volume; common fragments of hard caliche up to 4 cm in diameter comprising about 5 to 10 percent by volume; calcareous; moderately alkaline; clear smooth boundary.

C1ca—7 to 19 inches; white (10YR 8/2) slightly platy caliche which has a hardness of slightly less than 3 Mohs' scale, but can be cut with a spade; plates are fractured in places allowing some roots to penetrate; calcareous; moderately alkaline; gradual wavy boundary.

C2ca—19 to 30 inches; white (10YR 8/2) loamy material that contains about 60 percent caliche fragments and soft powdery caliche.

Thickness of the solum or depth to the Cca horizon ranges from 4 to 10 inches. It is moderately alkaline throughout.

The A horizon is brown, pale brown, light brown, grayish brown, or light brownish gray.

The Cca horizon is white caliche that is slightly platy in the upper part.

Pyote Series

The Pyote series consists of deep, sandy, soils on uplands. These soils formed in sandy unconsolidated sediment of eolian or outwash origin. Slope ranges from 0 to 5 percent.

Typical pedon of Pyote fine sand, 0 to 5 percent slopes, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 13.2 miles west on Texas Highway 158, 6.3 miles north on Texas Highway 137, and 2.05 miles east:

A11—0 to 6 inches; brown (7.5YR 5/4) fine sand, brown (7.5YR 4/4) moist; single grained; loose; many roots; noncalcareous; slightly acid; clear smooth boundary.

A12—6 to 26 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose; few roots; noncalcareous; slightly acid; clear smooth boundary.

B2t—26 to 46 inches; reddish yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; weak coarse prismatic parting to weak fine subangular blocky structure; loose, very friable, nonsticky; few of the sand grains are bridged with clay films; noncalcareous; slightly acid; gradual smooth boundary.

B3—46 to 60 inches; reddish yellow (5YR 6/8) loamy fine sand, yellowish red (5YR 5/8) moist; weak coarse prismatic parting to weak fine subangular blocky structure; loose, very friable, nonsticky; noncalcareous; neutral; diffuse wavy boundary.

C—60 to 80 inches; reddish yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6) moist; single grained; loose; noncalcareous; strongly acid.

The solum ranges from 40 to 80 inches in thickness.

The A horizon ranges from 20 to 40 inches in thickness. It is light reddish brown, reddish brown, light brown, or brown. It is slightly acid through mildly alkaline.

The B horizon is reddish yellow, reddish brown, red, or yellowish red. It is fine sandy loam or loamy fine sand with clay content of 8 to 18 percent in the control section. It is slightly acid through moderately alkaline.

The C horizon is reddish yellow, yellowish red, reddish brown, or pink. It is fine sandy loam, loamy fine sand, or fine sand. Some pedons have a Cca horizon below 60 inches.

This soil is considered to be a taxadjunct to the Pyote series because the P-E index and annual precipitation are slightly above the range allowed for the Pyote series. However, the morphology, use, behavior, and management are similar to that of the Pyote series. This soil is slightly more acid throughout than what is described for the established Pyote series.

Reagan Series

The Reagan series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy sediment, apparently of eolian origin. Slope ranges from 0 to 3 percent.

Typical pedon of Reagan silty clay loam, 0 to 1 percent slopes, in range; from the intersection of Texas Highway 158 and Ranch Road 33 in Garden City, 9.7 miles south on Ranch Road 33, 2.25 miles west on Farm Road 2401, and 30 feet south:

A11—0 to 4 inches; dark brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; weak fine granular and weak fine subangular blocky structure; hard, friable, sticky; many fine roots; many fine pores; light brownish gray (10YR 6/2) surface crust about 1/8 inch thick; calcareous; moderately alkaline; clear smooth boundary.

A12—4 to 10 inches; brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 4/2) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, sticky; common fine roots; many fine pores; few films and thread of visible calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21—10 to 19 inches; brown (7.5YR 5/4) silty clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, sticky; common fine roots; common pores; few films, threads, and weakly cemented concretions of visible calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—19 to 29 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic parting to weak medium subangular blocky structure; hard, friable, sticky; few fine roots; common pores; few films and threads of calcium carbonate and common fine weakly cemented concretions of calcium carbonate comprising about 4 percent by volume; calcareous; moderately alkaline; gradual wavy boundary.

B23ca—29 to 58 inches; pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; weak fine subangular blocky structure; hard, friable, sticky; many soft masses and weakly cemented concretions of visible calcium carbonate comprising about 40 percent by volume; calcareous; moderately alkaline; gradual wavy boundary.

B24ca—58 to 80 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak fine subangular blocky structure; hard, friable, sticky; many soft masses and weakly cemented concretions of visible calcium carbonate comprising about 20 percent by volume; calcareous; moderately alkaline.

The solum ranges from 40 to more than 80 inches in thickness. It is moderately alkaline throughout. Depth to the calcic horizon or B2ca horizon ranges from 20 to 38 inches.

The A horizon ranges from 6 to 12 inches in thickness. It is light brown, pale brown, brown, grayish brown, or dark brown. When moist value and chroma are less than 3.5, the A horizon is less than 7 inches thick.

The B2 horizon is silty clay loam or clay loam with clay content of 18 to 35 percent in the control section. The B2 horizon above the calcic horizon is light brown, pale brown, or brown. The B2ca horizon is pink, reddish yellow, or light brown. Calcium carbonate content in the B2ca horizon ranges from 15 to 60 percent, by volume.

Rioconcho Series

The Rioconcho series consists of deep, clayey, bottom land soils. These soils formed in calcareous, clayey sediment of alluvial origin. Slope ranges from 0 to 1 percent.

Typical pedon of Rioconcho silty clay, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 7.6 miles southeast on Texas Highway 158, 0.9 mile south on poor ranch road, and 50 feet east:

A11—0 to 16 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate medium granular and weak fine subangular blocky structure; hard, friable, sticky; many fine roots; common pores; calcareous; moderately alkaline; gradual smooth boundary.

A12—16 to 42 inches; dark brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; moderate medium blocky structure; very hard, very firm, very sticky and plastic; common fine roots; few very fine pores; common pressure faces; few lenses of very dark grayish brown (10YR 3/2) material; few visible fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B21—42 to 52 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few pressure faces; few common threads and soft masses of visible calcium carbonate comprising 2 to 5 percent by volume; calcareous; moderately alkaline; gradual wavy boundary.

B22—52 to 62 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; moderate medium blocky structure; hard, firm, sticky and plastic; few fine roots; few fine pores; few pressure faces; calcareous; moderately alkaline; diffuse wavy boundary.

C—62 to 80 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; few fine pores; thin lenses of pale brown (10YR 6/3) material; calcareous; moderately alkaline.

The solum ranges from 30 to 65 inches in thickness. When dry, this soil has cracks that are 0.5 to 1 inch wide and extend to depths of 20 to 30 inches.

The A horizon ranges from 20 to 50 inches in thickness. It is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. It is mildly alkaline or moderately alkaline.

The B2 horizon is clay loam, silty clay loam, clay, or silty clay with clay contents of 35 to 55 percent. It is brown or dark brown. It is moderately alkaline.

The C horizon is clay loam, silty clay loam, clay, or silty clay. It is brown, pale brown, grayish brown, or light brownish gray.

Slaughter Series

The Slaughter series consists of shallow, loamy soils on uplands. These soils formed in calcareous, loamy material that is indurated caliche in the upper part. Slope ranges from 0 to 1 percent.

Typical pedon of Slaughter clay loam, 0 to 1 percent slopes, in range; from the Midland-Glasscock County line marker on Texas Highway 158, 1.3 miles southeast on Texas Highway 158, 0.85 mile southwest on oilfield road, 1.0 mile west, 2.0 miles south, 0.27 mile west, and 30 feet south:

A1—0 to 8 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; many fine roots; common fine pores; noncalcareous; neutral; gradual smooth boundary.

B2t—8 to 18 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, firm, very sticky and plastic; common fine roots; few fine pores; thin nearly continuous clay films; noncalcareous; mildly alkaline; abrupt smooth boundary.

Ccam—18 to 20 inches; white indurated caliche.

Thickness of the solum or depth to the Ccam horizon ranges from 15 to 20 inches.

The A horizon ranges from 6 to 8 inches in thickness. It is grayish brown, reddish brown, or dark grayish brown. It is neutral through moderately alkaline.

The B2t horizon is clay loam or clay with clay content of 35 to 45 percent. It is reddish brown, red, or yellowish red. It is neutral through moderately alkaline.

The Ccam horizon is white indurated caliche 6 to 24 inches thick over softer caliche that is several feet thick.

Springer Series

The Springer series consists of deep, sandy soils on uplands. These soils formed in noncalcareous to calcareous, loamy sediments of outwash or eolian origin. Slope ranges from 0 to 3 percent.

Typical pedon of Springer loamy fine sand, 0 to 3 percent slopes, in range; from the intersection of Ranch Road 33 and Texas Highway 158 in Garden City, 13.2 miles west on Texas Highway 158, 10.1 miles north on Texas Highway 137, and 1.17 miles east:

A1—0 to 17 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; single grained; loose, very friable, nonsticky; common roots; noncalcareous; neutral; clear smooth boundary.

B21t—17 to 38 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic parting to weak fine subangular blocky structure; hard, friable, nonsticky; many fine pores; discontinuous clay films on prism faces; sand grains are bridged with clay films; noncalcareous; mildly alkaline; gradual smooth boundary.

B22t—38 to 60 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak coarse prismatic parting to weak fine subangular blocky structure; hard, friable, nonsticky; sand grains bridged with clay films; noncalcareous; mildly alkaline; diffuse wavy boundary.

B23t—60 to 80 inches; reddish yellow (5YR 6/8) fine sandy loam, yellowish red (5YR 5/8) moist; weak coarse prismatic parting to weak fine granular structure; hard, friable, nonsticky; sand grains bridged with clay films; noncalcareous; mildly alkaline.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon ranges from 12 to 20 inches in thickness. It is light brown, brown, reddish brown, or yellowish brown. It is neutral or mildly alkaline.

The B2t horizon is fine sandy loam with clay content of 12 to 18 percent in the control section. It is reddish brown, red, yellowish red, or reddish yellow. It is neutral through moderately alkaline.

Tobosa Series

The Tobosa series consists of deep, clayey, soils on uplands. These soils formed in calcareous, loamy and clayey sediment. They crack when dry and have weakly expressed gilgai microrelief. Slope ranges from 0 to 1 percent.

Typical pedon of Tobosa clay, 0 to 1 percent slopes, at the center of a microflat, in range; from the intersection of Texas Highway 158 and Ranch Road 33 in Garden City, 0.55 mile north on Ranch Road 33, and 50 feet east:

A11—0 to 7 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky and weak fine blocky structure; very hard, very firm, very sticky; many fine roots; few pores; calcareous; moderately alkaline; clear smooth boundary.

A12—7 to 24 inches; dark brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate medium blocky structure; very hard, very firm, very sticky; few roots; few shiny pressure faces on peds; calcareous; moderately alkaline; gradual smooth boundary.

AC—24 to 56 inches; dark brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate medium blocky structure; very hard, very firm, very sticky; few intersecting slickensides; few parallepipeds 1/8 inch long; few shiny pressure faces on peds; few weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—56 to 65 inches; reddish yellow (7.5YR 6/6) silty clay loam, strong brown (7.5YR 5/6) moist; massive; hard, firm, sticky; many soft masses and strongly cemented concretions up to 1 inch in diameter of calcium carbonate comprising about 20 percent by volume; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness.

In undisturbed areas, gilgai microrelief consists of microflats with microdepressions that are 4 to 20 inches deep and 2 to 4 feet wide. When the soil is dry, cracks as wide as 1 inch extend from the surface into the AC horizon. Intersecting slickensides begin at depths of about 20 to 30 inches.

The A horizon ranges from 16 to 30 inches in thickness. It is dark brown, dark grayish brown, or very dark grayish brown. It is mildly alkaline or moderately alkaline.

The AC horizon is clay or silty clay with clay content of 35 to 55 percent. It is brown, dark brown, grayish brown, or dark grayish brown. It is mildly alkaline or moderately alkaline.

The Cca horizon is pink, pale brown, reddish yellow, or yellowish red. Visible calcium carbonate ranges from 2 to 20 percent, by volume.

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(4) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Medium	6 to 9
High	More than 9

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if

less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microdepressions and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. Hydrous calcium sulphate.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characterisitc that affects management. These differencees are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Wind erodibility groups. Soils are grouped according to the following distinctions:

1. All sands, coarse sands, fine sands, and very fine sands. Extremely erodible; vegetation difficult to establish; generally not suitable for cropland.

2. All loamy sands, loamy fine sands, and loamy very fine sands. Very highly erodible; crops can be grown using intensive practices to control soil blowing.

3. All sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. Highly erodible; crops can be grown using intensive practices to control soil blowing.

4L. All calcareous loamy soils with less than 35 percent clay and more than 5 percent finely divided calcium carbonate. Erodible; crops can be grown using intensive practices to control soil blowing.

4. All clays and silty clays, all clay loams, and silty clay loams with more than 35 percent clay. Moderately erodible; crops can be grown using practices to control soil blowing.

5. All loamy soils with less than 18 percent clay and less than 5 percent finely divided calcium carbonate, and all sandy clay loams and sandy clays with less than 5 percent finely divided calcium carbonate. Slightly erodible; crops can be grown using practices to control soil blowing.

6. All other loamy soils with 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. Very slightly erodible; crops easily grown.

7. All silty clay loams with less than 35 percent clay and less than 5 percent finely divided calcium carbonate. Very slightly erodible; crops easily grown.

8. All stony or gravelly soils, or other soils not subject to soil blowing.

Illustrations

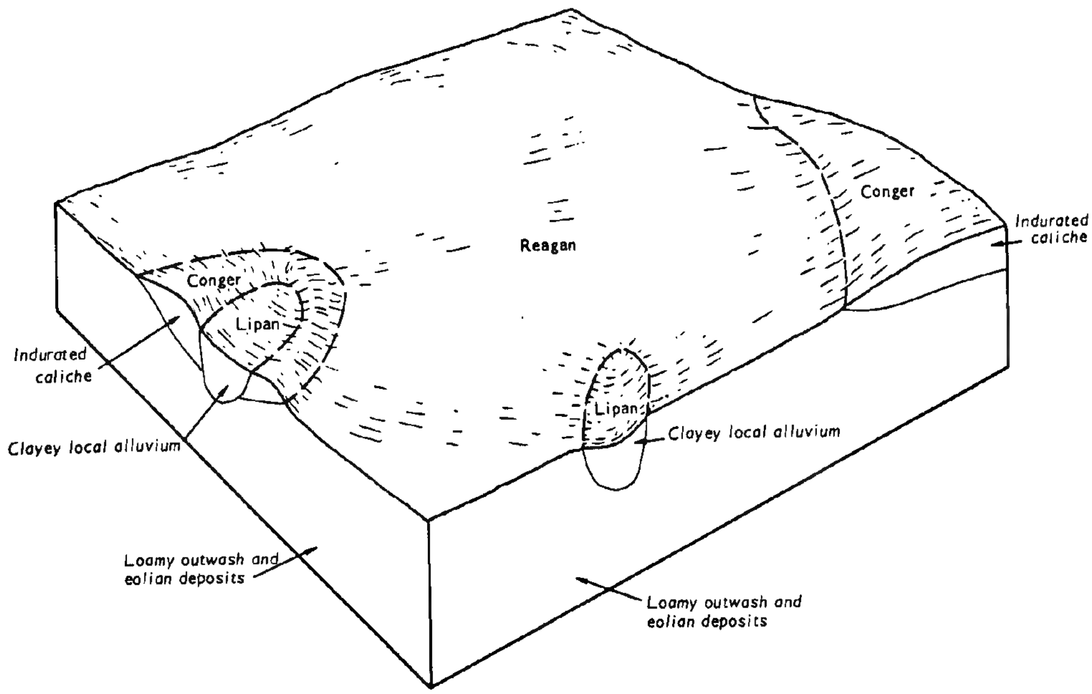

Figure 1.—Typical pattern of soils in the Reagan association.

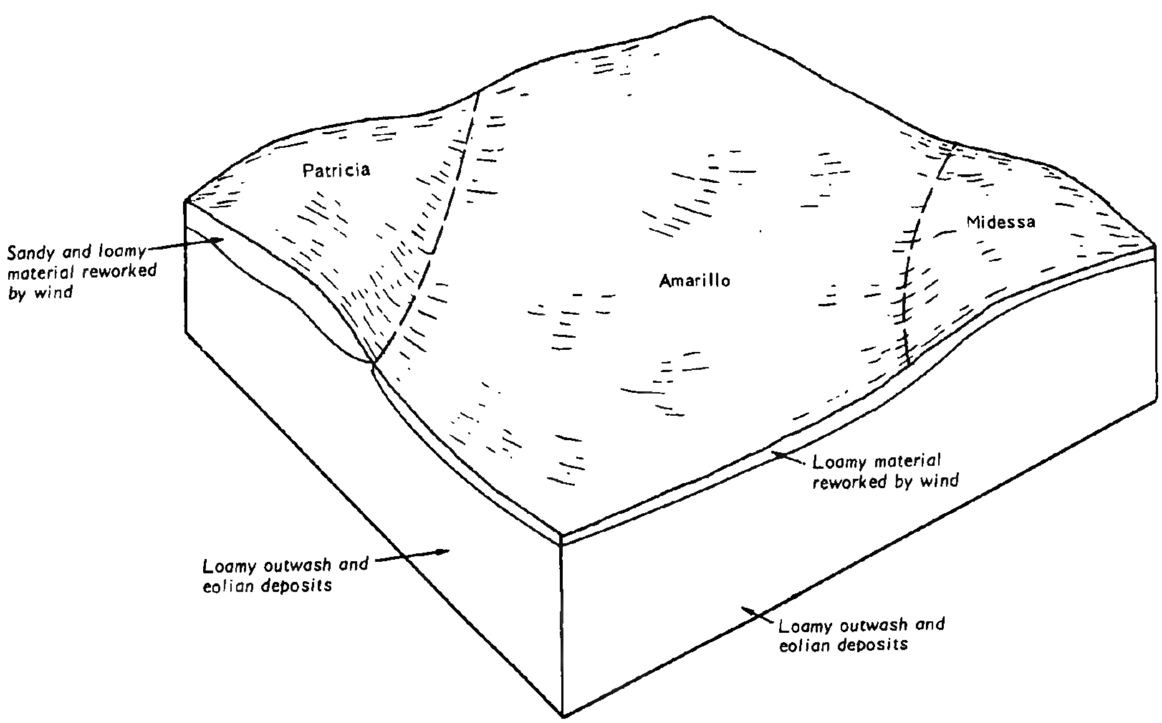

Figure 2.—Typical pattern of soils in the Amarillo-Midessa association.

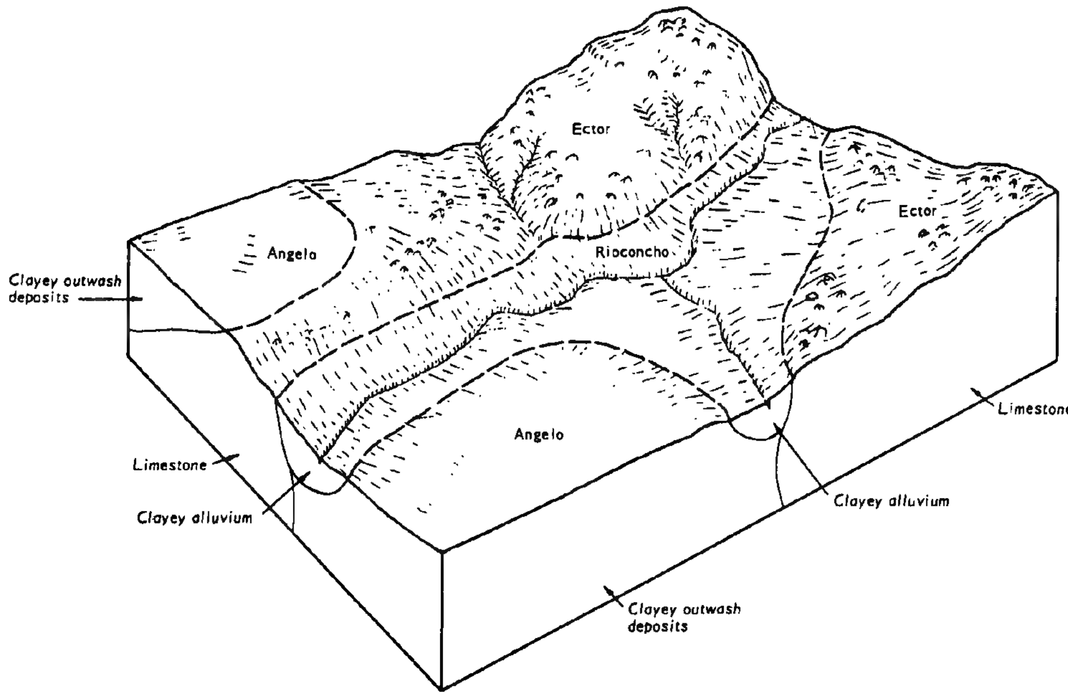

Figure 3.—Typical pattern of soils in the Ector association.

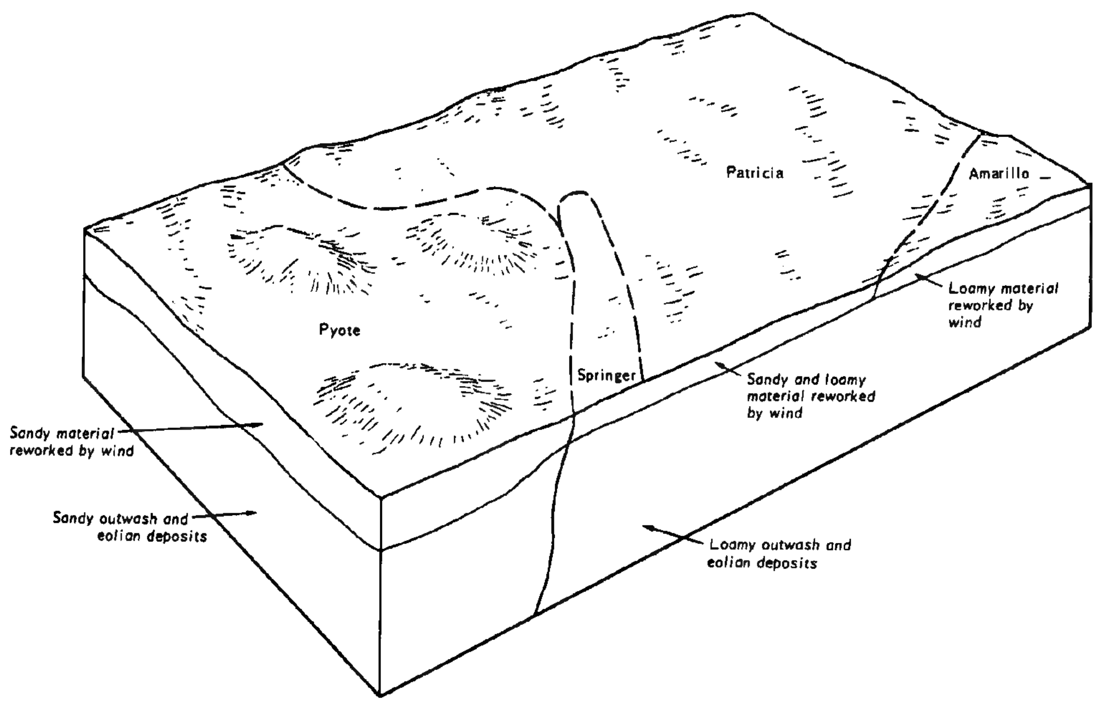

Figure 4.—Typical pattern of soils in the Patricia-Pyote association.

Figure 5.—Profile of Amarillo fine sandy loam.

Figure 6.—Profile of Angelo silty clay loam.

Figure 7.—Profile of Broome clay loam that has concentration of calcium carbonate at depth of about 19 inches.

Figure 8.—Profile of Conger clay loam. Layer of whitish indurated caliche begins at depth of about 12 inches rather than the typical 18 inches.

Figure 9.—Profile of Ector gravelly clay loam in an area of Ector association, undulating.

Figure 10.—Area of Ector association, undulating, in Limestone Hill range site. Rocky slopes and low forage potential are characteristic.

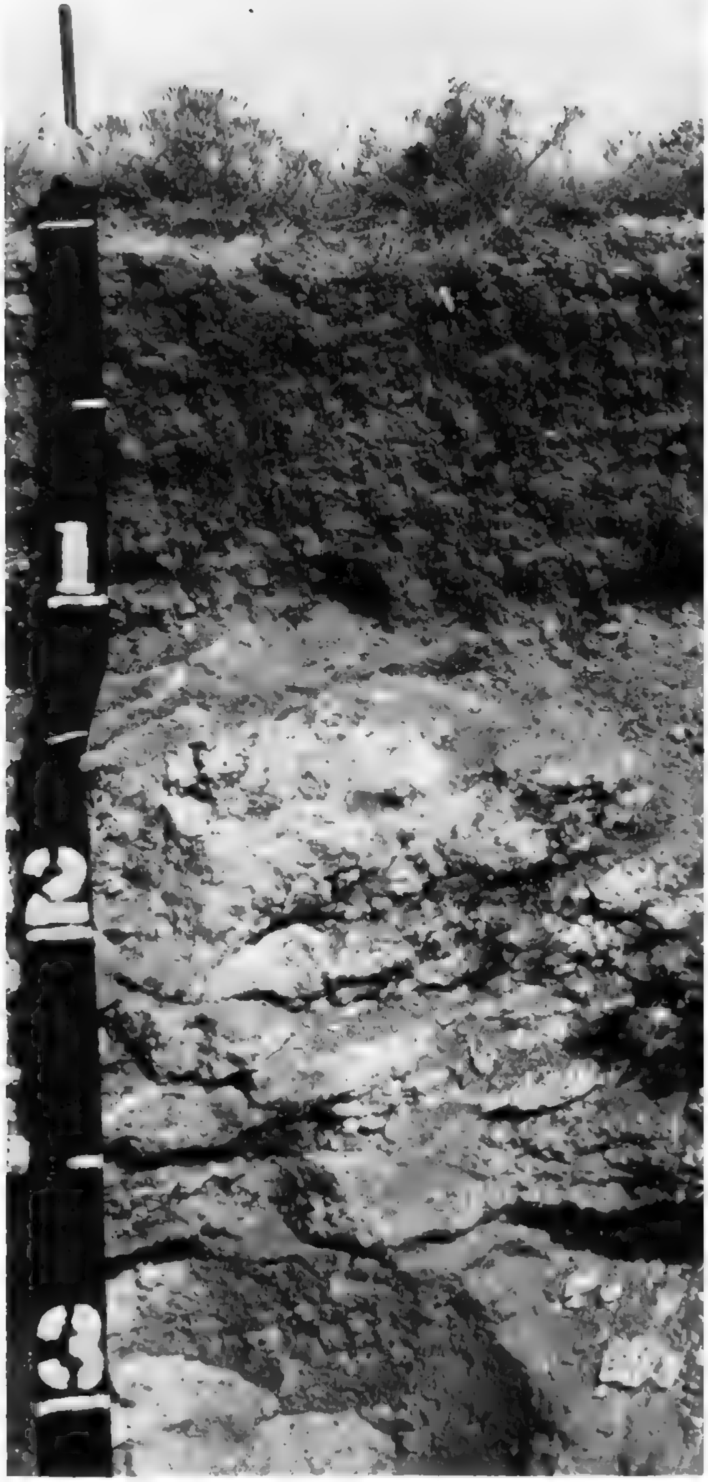

Figure 11.—Profile of Mereta clay loam. The abrupt layer of whitish indurated caliche at a depth of about 14 inches typically begins at a depth of about 17 inches.

Figure 12.—Profile of Rioconcho silty clay.

Tables

TABLE 1.--POTENTIALS AND LIMITATIONS OF SOIL ASSOCIATIONS FOR SPECIFIED USES

Association	Percentage of county	Cultivated crops	Specialty crops	Range	Urban use	Recreation
Reagan	36	High; soil blowing, water erosion.	High; soil blowing; water eroion.	Medium; soil blowing, water erosion.	Medium; shrink-swell, corrosivity, low strength, seepage.	Medum; too clayey, dusty, slope.
Angelo-Ricconcho	20	High; water erosion.	High; water erosion.	Medium; water erosion.	Medium; shrink-swell, corrosivity, low strength, percolation, flooding.	Medium; too clayey, percolation, slope, flooding.
Conger	16	Low; slope, water erosion, soil blowing, cemented pan.	Low; slope, water erosion, soil blowing, cemented pan.	Low; available water capacity, cemented pan.	Low; slope, cemented pan.	Medium; slope, dusty, cemented pan.
Amarillo-Midessa	13	High; soil blowing, water erosion, slope.	High; soil blowing, water erosion, slope.	High; slope, soil blowing, water erosion.	High; seepage, low strength, corrosivity, slope.	High; slope.
Ector	10	Low; water erosion, slope, small stones, depth to rock.	Low; water erosion, slope, small stones, depth to rock.	Low; slope, small stones, depth to rock, water erosion.	Low; slope, small stones, depth to rock.	Medium; slope, small stones, depth to rock.
Patricia-Pyote	5	Medium; soil blowing, available water capacity.	Medium; soil blowing, available water capacity.	High; soil blowing, available water capacity.	High; seepage, low strength.	Medium; slope. too sandy.

TABLE 2.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AcA	Acuff loam, 0 to 1 percent slopes	2,550	0.5
AmA	Amarillo fine sandy loam, 0 to 1 percent slopes	11,970	2.2
AmB	Amarillo fine sandy loam, 1 to 3 percent slopes	20,660	3.7
AnA	Angelo silty clay loam, 0 to 1 percent slopes	55,430	10.0
AnB	Angelo silty clay loam, 1 to 3 percent slopes	23,000	4.1
ArB	Arvana fine sandy loam, 1 to 3 percent slopes	380	0.1
BcA	Bippus clay loam, 0 to 1 percent slopes	6,370	1.2
BfB	Blakeney fine sandy loam, 1 to 3 percent slopes	900	0.2
BrB	Broome clay loam, 1 to 3 percent slopes	7,070	1.3
CnC	Conger clay loam, 1 to 5 percent slopes	78,540	14.2
COD	Cottonwood association, undulating	850	0.2
ECD	Ector association, undulating	50,430	9.1
EsA	Estacado clay loam, 0 to 1 percent slopes	1,070	0.2
Lc	Lipan clay, depressional	5,670	1.0
Ls	Lipan stony clay	980	0.2
MeB	Mereta clay loam, 1 to 3 percent slopes	9,030	1.6
MfA	Midessa fine sandy loam, 0 to 1 percent slopes	16,000	2.9
MfB	Midessa fine sandy loam, 1 to 3 percent slopes	12,140	2.2
MfC	Midessa fine sandy loam, 3 to 5 percent slopes	1,960	0.4
MoC	Monahans fine sandy loam, 1 to 5 percent slopes	1,350	0.2
PaB	Patricia loamy fine sand, 0 to 3 percent slopes	15,500	2.8
PoD	Potter soils, 3 to 8 percent slopes	560	0.1
PyC	Pyote fine sand, 0 to 5 percent slopes	8,390	1.5
ReA	Reagan silty clay loam, 0 to 1 percent slopes	174,914	31.6
ReB	Reagan silty clay loam, 1 to 3 percent slopes	23,330	4.2
Ro	Rioconcho silty clay	14,390	2.6
ScA	Slaughter clay loam, 0 to 1 percent slopes	180	([1])
SpB	Springer loamy fine sand, 0 to 3 percent slopes	4,360	0.8
ToA	Tobosa clay, 0 to 1 percent slopes	4,410	0.8
	Water	576	0.1
	Total	552,960	100.0

[1]Less than 0.1 percent.

TABLE 3.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only those potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Dashes mean no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	244,734	---	---	---	---
II (N)	20,760	---	6,370	---	14,390
(I)	91,360	84,990	6,370	---	---
III (N)	163,710	103,870	---	4,410	55,430
(I)	53,040	53,040	---	---	---
IV (N)	225,914	45,150	5,670	180	174,914
(I)	---	---	---	---	---
V (N)	---	---	---	---	---
VI (N)	90,160	89,180	980	---	---
VII (N)	51,840	---	---	51,840	---
VIII (N)	---	---	---	---	---

TABLE 4.--YIELDS PER ACRE OF CROPS

[Yields in columns N are for nonirrigated soils; those in columns I are for irrigated soils. All yields are those to be expected under a high level of management. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Cotton		Grain sorghum		Wheat	
	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu
Acuff:						
AcA	200	900	25	110	18	50
Amarillo:						
AmA	250	1,000	25	110	15	50
AmB	200	850	20	100	12	45
Angelo:						
AnA	200	1100	30	110	20	45
AnB	200	900	30	100	15	40
Arvana:						
ArB	175	700	20	85	12	45
Bippus:						
BcA	225	900	25	110	18	60
Blakeney:						
BfB	---	---	---	---	---	---
Broome:						
BrB	250	800	25	50	12	40
Conger:						
CnC	---	---	---	---	---	---
Cottonwood:						
[1]COD	---	---	---	---	---	---
Ector:						
[1]ECD	---	---	---	---	---	---
Estacado:						
EsA	200	750	25	100	18	45
Lipan:						
Lc	250	---	20	---	15	---
Ls	---	---	---	---	---	---
Mereta:						
MeB	150	---	20	---	15	---
Midessa:						
MfA	200	850	20	80	15	40
MfB	150	700	15	70	12	35
MfC	---	---	12	---	10	---
Monahans:						
MoC	---	---	---	---	---	---
Patricia:						
PaB	225	750	20	100	12	---
Potter:						
[1]PoD	---	---	---	---	---	---
Pyote:						
PyC	---	---	---	---	---	---

See footnote at end of table.

TABLE 4.-- YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Cotton		Grain sorghum		Wheat	
	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu
Reagan:						
ReA	---	1,250	20	90	12	40
ReB	---	1,000	15	75	10	35
Rioconcho:						
Ro	200	1,000	30	110	20	45
Slaughter:						
ScA	---	---	---	---	---	---
Springer:						
SpB	175	600	20	75	---	---
Tobosa:						
ToA	250	---	30	---	20	---

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 5.—RANGE PRODUCTIVITY AND COMPOSITION

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Acuff:					
AcA	Clay loam	Favorable	2,100	Blue grama	30
		Normal	1,600	Buffalograss	25
		Unfavorable	1,200	Vine-mesquite	10
				Side-oats grama	5
				Tobosa	5
				Other shrubs	5
				Other annual grasses	5
				Other perennial grasses	5
				Other annual forbs	5
				Other perennial forbs	5
Amarillo:					
AmA, AmB	Sandy loam	Favorable	2,800	Black grama	20
		Normal	2,100	Side-oats grama	15
		Unfavorable	1,400	Buffalograss	10
				Arizona cottontop	10
				Cane bluestem	10
				Plains bristlegrass	5
				Little bluestem	5
				Sand dropseed	5
				Other perennial grasses	5
				Other annual forbs	5
				Other perennial forbs	5
				Other shrubs	5
Angelo:					
AnA, AnB	Clay loam	Favorable	2,400	Side-oats grama	25
		Normal	1,700	Cane bluestem	5
		Unfavorable	1,300	Curly mesquite	10
				Buffalograss	10
				Vine-mesquite	5
				Tall dropseed	5
				Texas wintergrass	5
				Tobosa	25
				Slim tridens	5
				Other annual forbs	4
				Other shrubs	1
Arvana:					
ArB	Sandy loam	Favorable	2,700	Black grama	20
		Normal	2,000	Side-oats grama	15
		Unfavorable	1,300	Buffalograss	10
				Arizona cottontop	10
				Cane bluestem	10
				Plains bristlegrass	5
				Little bluestem	5
				Sand dropseed	5
				Other shrubs	5
				Other perennial grasses	5
				Other annual forbs	5
				Other perennial forbs	5
Bippus:					
BcA	Draw	Favorable	3,000	Side-oats grama	25
		Normal	2,400	Vine-mesquite	10
		Unfavorable	1,800	Blue grama	10
				Western wheatgrass	10
				Little bluestem	5
				Arizona cottontop	5
				Plains bristlegrass	5
				White tridens	5
				Buffalograss	5
				Other perennial grasses	10
				Other annual grasses	5
				Other perennial forbs	5

TABLE 5.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Compo- sition
			Lb/acre		Pct
Blakeney:					
BfB	Shallow	Favorable	1,400	Black grama	30
		Normal	1,000	Side-oats grama	25
		Unfavorable	700	Plains bristlegrass	10
				Arizona cottontop	5
				Buffalograss	5
				Sand dropseed	5
				Burrograss	5
				Other perennial forbs	10
				Other perennial grasses	5
Broome:					
BrB	Loamy	Favorable	2,100	Buffalograss	15
		Normal	1,200	Sideoats grama	10
		Unfavorable	600	Tobosa	10
				Burrograss	10
				Wright three-awn	10
				Vine-mesquite	5
				Plains bristlegrass	5
				Cane bluestem	5
				Fall witchgrass	5
				Sand dropseed	5
				Mesquite	5
				Other annual forbs	10
				Other shrubs	5
Conger:					
CnC	Shallow	Favorable	1,400	Black grama	30
		Normal	1,000	Side-oats grama	25
		Unfavorable	700	Plains bristlegrass	10
				Arizona cottontop	5
				Buffalograss	5
				Sand dropseed	5
				Burrograss	5
				Other perennial forbs	10
				Other perennial grasses	5
Cottonwood:					
[1]COD	Gyp	Favorable	900	Side-oats grama	20
		Normal	650	Little bluestem	10
		Unfavorable	300	Sand dropseed	5
				Indiangrass	5
				Plains bristlegrass	5
				Vine-mesquite	5
				Arizona cottontop	5
				Tobosa	5
				Blue grama	5
				Hairy grama	5
				Buffalograss	5
				Black grama	5
				Other shrubs	5
				Other perennial grasses	10
				Other peennial forbs	5
Ector:					
[1]ECD	Limestone hill	Favorable	900	Black grama	15
		Normal	700	Side-oats grama	15
		Unfavorable	400	Blue grama	10
				Slim tridens	5
				Bush muhly	5
				Cane bluestem	5
				Little bluestem	5
				Fall witchgrass	5
				Green sprangletop	5
				Plains bristlegrass	5
				Other perennial grasses	10
				Other perennial forbs	10
				Other shrubs	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Estacado:					
EsA	Clay loam	Favorable	2,200	Blue grama	20
		Normal	1,700	Side-oats grama	30
		Unfavorable	1,300	Buffalograss	20
				Vine-mesquite	5
				Other perennial grasses	10
				Other annual grasses	5
				Other annual forbs	5
				Other perennial forbs	5
Lipan:					
Lc, Ls	Lakebed	Favorable	2,400	Buffalograss	25
		Normal	1,500	Vine-mesquite	15
		Unfavorable	500	White tridens	10
				Knotgrass	10
				Other perennial grasslikes	10
				Other annual forbs	10
				Other annual grasses	5
				Other perennial forbs	5
Mereta:					
MeB	Shallow	Favorable	1,500	Side-oats grama	25
		Normal	1,100	Buffalograss	13
		Unfavorable	800	Curly mesquite	10
				Slim tridens	10
				Wright three-awn	5
				Reverchon panicum	5
				Plains bristlegrass	5
				Cane bluestem	5
				Arizona cottontop	5
				Green sprangletop	5
				Texas wintergrass	5
				Other perennial forbs	5
				Other shrubs	2
Midessa:					
MfA, MfB, MfC	Sandy loam	Favorable	2,800	Black grama	20
		Normal	2,100	Side-oats grama	15
		Unfavorable	1,400	Buffalograss	10
				Arizona cottontop	10
				Cane bluestem	10
				Plains bristlegrass	5
				Little bluestem	5
				Sand dropseed	5
				Other perennial grasses	10
				Other annual grasses	5
				Other perennial forbs	5
Monahans:					
MoC	Sandy loam	Favorable	2,500	Black grama	20
		Normal	1,800	Blue grama	10
		Unfavorable	1,200	Sand dropseed	5
				Plains bristlegrass	5
				Arizona cottontop	5
				Hooded windmillgrass	5
				Slim tridens	5
				Fall witchgrass	5
				Side-oats grama	10
				Cane bluestem	10
				Other perennial forbs	10
				Other shrubs	5
				Other perennial grasses	5

TABLE 5.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Patricia:					
PaB	Loamy sand	Favorable	3,000	Little bluestem	30
		Normal	2,200	Side-oats grama	15
		Unfavorable	1,200	Blue grama	5
				Plains bristlegrass	5
				Sand dropseed	5
				Sand bluestem	5
				Sand lovegrass	5
				Hairy grama	5
				Other shrubs	10
				Other perennial grasses	10
				Other perennial forbs	5
Potter:					
[1]PoD	Very shallow	Favorable	900	Side-oats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Arizona cottontop	5
				Hairy grama	5
				Black grama	5
				Other perennial grasses	10
				Other annual grasses	5
				Other perennial forbs	5
				Other shrubs	5
Pyote:					
PyC	Sandy	Favorable	2,400	Little bluestem	15
		Normal	1,800	Sand bluestem	5
		Unfavorable	1,200	Cane bluestem	10
				Side-oats grama	10
				Giant dropseed	5
				Sand dropseed	5
				Plains bristlegrass	5
				Arizona cottontop	5
				Black grama	5
				Hooded windmillgrass	10
				Other perennial forbs	10
				Other shrubs	10
				Other perennial grasses	5
Reagan:					
ReA, ReB	Loamy	Favorable	1,800	Tobosa	20
		Normal	1,200	Buffalograss	15
		Unfavorable	600	Side-oats grama	15
				Burrograss	15
				Vine-mesquite	5
				Fall witchgrass	5
				Sand muhly	5
				Other perennial grasses	10
				Other shrubs	5
				Other annual grasses	5
Rioconcho:					
Ro	Clayey bottomland	Favorable	3,500	Tobosa	30
		Normal	3,000	Buffalograss	15
		Unfavorable	2,000	Side-oats grama	20
				Vine-mesquite	15
				Silver bluestem	5
				Curly mesquite	5
				Texas wintergrass	3
				Other annual forbs	5
				Other shrubs	2

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Slaughter:					
ScA	Clay loam	Favorable	2,000	Buffalograss	25
		Normal	1,500	Blue grama	25
		Unfavorable	1,000	Tobosa	15
				Side-oats grama	10
				Vine-mesquite	5
				Cane bluestem	5
				Other perennial grasses	10
				Other perennial forbs	5
Springer:					
SpB	Loamy sand	Favorable	2,500	Little bluestem	15
		Normal	1,800	Side-oats grama	10
		Unfavorable	1,200	Blue grama	10
				Plains bristlegrass	5
				Arizona cottontop	5
				Sand dropseed	5
				Hooded windmillgrass	5
				Sand bluestem	5
				Yellow indiangrass	5
				Switchgrass	5
				Spike dropseed	5
				Other perennial grasses	10
				Other shrubs	10
				Other perennial forbs	5
Tobosa:					
ToA	Clay flat	Favorable	2,400	Tobosa	40
		Normal	1,700	Buffalograss	15
		Unfavorable	1,000	Side-oats grama	10
				Curly mesquite	5
				Cane bluestem	5
				Vine-mesquite	5
				Texas wintergrass	5
				Wright three-awn	5
				Other annual forbs	5
				Other perennial forbs	5

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 6.--BUILDING SITE DEVELOPMENT

["Shrink-swell" and other terms that describe restrictive soil features are defined in the Glossary. See text definition of "slight,"moderate," and "severe". Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Acuff: AcA	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
Amarillo: AmA, AmB	Slight	Slight	Slight	Slight	Moderate: low strength.
Angelo: AnA, AnB	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Arvana: ArB	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight.
Bippus: BcA	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Blakeney: BfB	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.
Broome: BrB	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
Conger: CnC	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.
Cottonwood: [1]COD	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.
Ector: [1]ECD	Severe: depth to rock, small stones.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Estacado: EsA	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
Lipan: Lc, Ls	Severe: floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
Mereta: MeB	Moderate: cemented pan.	Moderate: cemented pan, shrink-swell.	Moderate: cemented pan, shrink-swell.	Moderate: cemented pan, shrink-swell.	Moderate: cemented pan, shrink-swell.
Midessa: MfA, MfB, MfC	Slight	Slight	Slight	Slight	Moderate: low strength.
Monahans: MoC	Slight	Slight	Slight	Slight	Moderate: low strength.

See footnote at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Patricia:					
PaB	Slight	Slight	Slight	Slight	Moderate: low strength.
Potter:					
[1]PoD	Moderate: small stones.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Pyote:					
PyC	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Reagan:					
ReA, ReB	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
Rioconcho:					
Ro	Severe: floods.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
Slaughter:					
ScA	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, low strength.
Springer:					
SpB	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Tobosa:					
ToA	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 7.--SANITARY FACILITIES

["Shrink-swell" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe" used to rate soils. Absence of an entry means the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Acuff: AcA	Slight	Moderate: seepage.	Slight	Slight	Good.
Amarillo: AmA, AmB	Slight	Moderate: seepage.	Slight	Slight	Good.
Angelo: AnA, AnB	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Fair.
Arvana: ArB	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Fair: thin layer.
Bippus: BcA	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Blakeney: BfB	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Poor: thin layer.
Broome: BrB	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Conger: CnC	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Poor: thin layer.
Cottonwood: [1]COD	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Ector: [1]ECD	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, small stones.
Estacado: EsA	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Lipan: Lc, Ls	Severe: floods, percs slowly.	Slight	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
Mereta: MeB	Severe: cemented pan, percs slowly.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Poor: thin layer.
Midessa: MfA	Slight	Moderate: seepage.	Slight	Slight	Good.
MfB, MfC	Slight	Moderate: seepage, slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 7.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Monahans:					
MoC	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
Patricia:					
PaB	Slight	Moderate: seepage.	Slight	Slight	Good.
Potter:					
[1]PoD	Severe: seepage.	Moderate: seepage.	Moderate: small stones.	Slight	Poor: thin layer.
Pyote:					
PyC	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
Reagan:					
ReA, ReB	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Rioconcho:					
Ro	Severe: percs slowly, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Slaughter:					
ScA	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer.
Springer:					
SpB	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
Tobosa:					
ToA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 8.--CONSTRUCTION MATERIALS

["Shrink-swell" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Acuff: AcA	Fair: low strength.	Unsuited	Unsuited	Fair: too clayey.
Amarillo: AmA, AmB	Fair: low strength.	Unsuited	Unsuited	Fair: thin layer.
Angelo: AnA, AnB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
Arvana: ArB	Poor: thin layer.	Unsuited	Unsuited	Fair: thin layer.
Bippus: BcA	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
Blakeney: BfB	Poor: thin layer.	Unsuited	Unsuited	Fair: thin layer.
Broome: BrB	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: excess lime, too clayey.
Conger: CnC	Poor: thin layer.	Unsuited	Unsuited	Fair: thin layer.
Cottonwood: [1]COD	Poor: thin layer.	Unsuited	Unsuited	Poor: thin layer, excess salt.
Ector: [1]ECD	Poor: thin layer.	Unsuited	Unsuited	Poor: thin layer, small stones.
Estacado: EsA	Fair: low strength.	Unsuited	Unsuited	Fair: too clayey, excess lime.
Lipan: Lc, Ls	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Mereta: MeB	Fair: shrink-swell, low strength.	Unsuited	Unsuited	Poor: area reclaim.
Midessa: MfA, MfB, MfC	Fair: low strength.	Unsuited	Unsuited	Fair: thin layer.

See footnote at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Monahans: MoC	Fair: low strength.	Unsuited	Unsuited	Fair: thin layer.
Patricia: PaB	Good	Unsuited	Unsuited	Poor: too sandy.
Potter: [1]PoD	Good	Unsuited	Unsuited	Poor: thin layer, small stones.
Pyote: PyC	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
Reagan: ReA, ReB	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey, excess lime.
Rioconcho: Ro	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Slaughter: ScA	Poor: thin layer, low strength.	Unsuited	Unsuited	Fair: thin layer, too clayey.
Springer: SpB	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
Tobosa: ToA	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 9.--WATER MANAGEMENT

["Seepage," "slope," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond resevoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
Acuff: AcA	Moderate: seepage.	Moderate: seepage.	Erodes easily	Favorable	Favorable.
Amarillo: AmA, AmB	Moderate: seepage.	Moderate: seepage, piping.	Erodes easily	Favorable	Favorable.
Angelo: AnA, AnB	Moderate: seepage.	Moderate: compressible.	Slow intake	Favorable	Favorable.
Arvana: ArB	Severe: cemented pan.	Moderate: thin layer.	Erodes easily, rooting depth.	Cemented pan, rooting depth.	Rooting depth.
Bippus: BcA	Moderate: seepage.	Moderate: low strength, shrink-swell.	Favorable	Favorable	Favorable.
Blakeney: BfB	Severe: cemented pan, seepage.	Severe: thin layer, seepage.	Rooting depth, droughty.	Cemented pan	Rooting depth, droughty.
Broome: BrB	Moderate: seepage.	Moderate: compressible, piping.	Droughty, excess lime.	Favorable	Favorable.
Conger: CnC	Severe: cemented pan, seepage.	Severe: thin layer, seepage.	Rooting depth, droughty.	Cemented pan	Rooting depth, droughty.
Cottonwood: [1]COD	Severe: depth to rock, seepage.	Severe: unstable fill, seepage, thin layer.	Droughty, rooting depth, excess salt.	Depth to rock, rooting depth.	Droughty, rooting depth, excess salt.
Ector: [1]ECD	Severe: depth to rock.	Severe: thin layer.	Rooting depth	Depth to rock	Rooting depth.
Estacado: EsA	Moderate: seepage.	Moderate: seepage, low strength.	Erodes easily	Favorable	Favorable.
Lipan: Lc, Ls	Slight	Moderate: compressible, unstable fill.	Floods, slow intake.	Percs slowly	Percs slowly.
Mereta: MeB	Severe: cemented pan.	Severe: thin layer.	Rooting depth	Cemented pan, rooting depth.	Rooting depth, droughty.
Midessa: MfA, MfB, MfC	Moderate: seepage.	Moderate: seepage, piping.	Erodes easily, fast intake.	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond resevoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
Monahans: MoC	Moderate: seepage.	Moderate: piping, low strength, seepage.	Droughty, erodes easily, rooting depth.	Erodes easily, rooting depth.	Droughty, erodes easily, rooting depth.
Patricia: PaB	Moderate: seepage.	Moderate: piping.	Erodes easily	Too sandy	Favorable.
Potter: [1]PoD	Severe: seepage.	Severe: thin layer, seepage.	Rooting depth, droughty, complex slope.	Complex slope, depth to rock.	Droughty, rooting depth, slope.
Pyote: PyC	Severe: seepage.	Moderate: seepage, piping.	Fast intake, erodes easily.	Too sandy, erodes easily.	Erodes easily.
Reagan: ReA, ReB	Moderate: seepage.	Moderate: piping.	Favorable	Favorable	Favorable.
Rioconcho: Ro	Moderate: seepage.	Moderate: compressible, piping.	Floods, slow intake.	Percs slowly	Percs slowly.
Slaughter: ScA	Severe: cemented pan.	Severe: thin layer.	Rooting depth, droughty, slow intake.	Cemented pan, rooting depth.	Rooting depth, droughty.
Springer: SpB	Severe: seepage.	Moderate: seepage, piping.	Fast intake, erodes easily.	Too sandy, erodes easily.	Erodes easily.
Tobosa: ToA	Slight	Moderate: compressible, unstable fill.	Slow intake	Percs slowly	Percs slowly.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

["Shrink-swell" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Acuff:				
AcA	Slight	Slight	Slight	Slight.
Amarillo:				
AmA	Slight	Slight	Slight	Slight.
AmB	Slight	Slight	Moderate: slope.	Slight.
Angelo:				
AnA, AnB	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
Arvana:				
ArB	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Bippus:				
BcA	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Blakeney:				
BfB	Moderate: dusty.	Moderate: dusty.	Severe: depth to rock.	Moderate: dusty.
Broome:				
BrB	Moderate: dusty, too clayey.	Moderate: dusty, too clayey.	Moderate: dusty, too clayey, slope.	Moderate: dusty, too clayey.
Conger:				
CnC	Moderate: dusty.	Moderate: dusty.	Severe: depth to rock.	Moderate: dusty.
Cottonwood:				
[1]COD	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Ector:				
[1]ECD	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: depth to rock, slope.	Moderate: slope, small stones.
Estacado:				
EsA	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Lipan:				
Lc, Ls	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey.	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey.
Mereta:				
MeB	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: cemented pan.	Moderate: too clayey.
Midessa:				
MfA	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Midessa:				
MfB, MfC	Slight	Slight	Moderate: slope.	Slight.
Monahans:				
MoC	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Patricia:				
PaB	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Potter:				
[1]PoD	Slight	Slight	Moderate: slope, small stones.	Slight.
Pyote:				
PyC	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Reagan:				
ReA	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.
ReB	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.	Moderate: slope, dusty.	Moderate: too clayey, dusty.
Rioconcho:				
Ro	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Slaughter:				
ScA	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: depth to rock.	Moderate: too clayey.
Springer:				
SpB	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Tobosa:				
ToA	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 11.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
Acuff: AcA	Fair	Fair	Fair	Fair	Fair	Fair.
Amarillo: AmA, AmB	Fair	Fair	Fair	Fair	Fair	Fair.
Angelo: AnA, AnB	Fair	Fair	Fair	Fair	Fair	Fair.
Arvana: ArB	Fair	Fair	Fair	Fair	Fair	Fair.
Bippus: BcA	Good	Good	Good	Good	Good	Good
Blakeney: BfB	Poor	Poor	Fair	Fair	Poor	Fair.
Broome: BrB	Fair	Fair	Fair	Fair	Fair	Fair.
Conger: CnC	Poor	Poor	Fair	Fair	Poor	Fair.
Cottonwood: [1]COD	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Ector: [1]ECD	Very poor.	Very poor.	Fair	Fair	Poor	Fair.
Estacado: EsA	Fair	Fair	Fair	Fair	Fair	Fair.
Lipan: Lc	Fair	Fair	Fair	Very poor.	Fair	Poor.
Ls	Poor	Poor	Poor	Very poor.	Poor	Very poor.
Mereta: MeB	Fair	Fair	Fair	Fair	Fair	Fair.
Midessa: MfA, MfB, MfC	Fair	Fair	Fair	Fair	Fair	Fair.
Monahans: MoC	Poor	Poor	Fair	Fair	Poor	Fair.
Patricia: PaB	Poor	Fair	Fair	Fair	Fair	Fair.
Potter: [1]PoD	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Pyote: PyC	Poor	Fair	Fair	Fair	Fair	Fair.
Reagan: ReA, ReB	Fair	Good	Fair	Fair	Fair	Fair.
Rioconcho: Ro	Good	Good	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
Slaughter:						
SoA	Poor	Poor	Fair	Fair	Poor	Fair.
Springer:						
SpB	Poor	Fair	Fair	Fair	Fair	Fair.
Tobosa:						
ToA	Fair	Fair	Poor	Fair	Fair	Poor.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Acuff: AcA	0-8	Loam	CL	A-4, A-6	0	100	95-100	95-100	51-70	24-32	10-16
	8-45	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	95-100	65-75	28-45	12-25
	45-80	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-75	25-42	12-25
Amarillo: AmA, AmB	0-8	Fine sandy loam	SM, SM-SC, CL-ML	A-2-4, A-4	0	100	100	95-100	35-55	17-25	3-7
	8-52	Sandy clay loam, clay loam.	SC, SM-SC, CL	A-4, A-6, A-2-4	0	100	100	95-100	35-65	20-40	7-20
	52-80	Sandy clay loam, clay loam.	SC, CL, SM-SC	A-4, A-6, A-2-4	0	90-100	90-100	65-98	35-70	20-35	7-17
Angelo: AnA, AnB	0-8	Silty clay loam	CL	A-6, A-7-6	0	90-100	90-100	85-100	60-90	37-50	16-27
	8-26	Clay, silty clay, clay loam silty clay loam	CL, CH	A-6, A-7-6	0	90-100	90-100	85-100	70-92	39-60	18-35
	26-80	Clay loam, silty clay loam, clay, silty clay.	CL, CH	A-6, A-7-6	0	60-100	60-100	60-100	50-90	35-55	15-30
Arvana: ArB	0-9	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	100	100	75-95	30-50	17-25	2-7
	9-28	Sandy clay loam	SC, CL, CL-ML, SM-SC	A-4, A-6	0	100	100	80-98	36-65	20-35	5-18
	28-40	Variable, indurated, caliche.									
	40-70	Variable, caliche.									
Bippus: BcA	0-24	Clay loam	CL, SC, SM-SC	A-4, A-6	0	100	95-100	85-98	36-80	22-40	7-20
	24-62	Clay loam, loam, sandy clay loam.	SC, CL, SM-SC	A-4, A-6	0	100	95-100	85-98	36-75	22-40	7-20
Blakeney: BfB	0-13	Fine sandy loam	SC, CL, CL ML, SM-SC	A-4, A-2-4	0-5	75-95	70-95	60-85	30-55	18-27	4-10
	13-35	Variable, indurated, caliche.									
	36-60	Variable, caliche.									
Broome: BrB	0-7	Clay loam	CL	A-6, A-7	0	95-100	90-100	85-100	85-100	36-44	17-25
	7-36	Clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	85-100	80-100	70-98	38-49	19-28
	36-70	Clay loam, silty clay loam.	CL	A-6	0	95-100	90-100	85-100	80-100	31-40	13-20

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Conger:											
CnC	0-18	Clay loam	CL, CL-ML	A-4, A-6	0-5	75-95	70-95	65-90	51-75	20-40	5-20
	18-35	Variable, indurated, caliche.									
	35-60	Variable, caliche.									
Cottonwood:											
[1]COD	0-7	Loam	CL, CL-ML	A-4, A-6	0	100	100	85-100	55-75	20-35	4-15
	7-20	Variable, chalky gypsum.									
Ector:											
[1]ECD	0-9	Gravelly clay loam.	GC, SC	A-2-4, A-2-6	5-45	30-70	20-65	15-50	13-35	25-35	8-15
	9-40	Variable, fractured limestone bedrock.									
Estacado:											
EsA	0-16	Clay loam	CL	A-6, A-4	0	95-100	95-100	55-100	51-90	25-40	8-20
	16-25	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	55-90	30-42	12-25
	25-80	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	80-100	60-95	30-45	13-25
Lipan:											
Lc	0-55	Clay	CH	A-7-6	0	85-100	80-100	80-100	80-95	55-75	32-49
	55-70	Clay, silty clay	CH	A-7-6	0	85-100	80-100	80-100	70-95	46-66	25-40
Ls	0-55	Stony clay	CH	A-7-6	0-15	85-100	80-100	80-100	80-95	55-75	32-49
	55-70	Clay, silty clay	CH	A-7-6	0-15	85-100	80-100	80-100	70-95	46-66	25-40
Mereta:											
MeB	0-17	Clay loam	CL, CH	A-6, A-7-6	0-5	90-100	83-100	80-97	60-85	39-52	19-30
	17-35	Variable, indurated, caliche.									
	35-60	Variable, limy earth.									
Midessa:											
MfA, MfB, MfC	0-9	Fine sandy loam	SM, SM-SC, CL, SC	A-2-4, A-4	0	95-100	95-100	85-100	30-55	17-27	4-9
	9-34	Sandy clay loam	CL, SC, SM-SC, CL-ML	A-6, A-4	0	95-100	95-100	90-100	36-80	22-35	7-17
	34-80	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-6, A-4	0	90-100	85-100	80-100	40-80	22-35	7-17
Monahans:											
MoC	0-6	Fine sandy loam	SM, SC, SM-SC	A-2-4, A-4, A-6	0	90-100	90-100	70-98	25-50	18-30	3-12
	6-17	Loam, sandy clay loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-2-4, A-4, A-6, A-2-6	0	90-100	90-100	80-98	30-65	20-35	4-15
	17-60	Loam, fine sandy loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-2-4, A-2-6, A-4, A-6	0	75-100	70-95	55-90	25-60	20-35	4-15

See footnote at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Patricia:											
PaB	0-14	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4	0	100	95-100	95-100	5-30	<24	NP-4
	14-80	Sandy clay loam	SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0	100	95-100	95-100	30-45	20-35	7-18
Potter:											
[1]PoD	0-7	Loam	CL, ML, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	7-30	Variable, caliche.	GM, GC, SM, SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
Pyote:											
PyC	0-26	Fine sand	SM, SP-SM	A-2-4, A-3	0	100	100	95-100	5-20	<22	NP-3
	26-80	Fine sandy loam, loamy fine sand, fine sand	SM, SM-SC	A-2-4	0	100	100	95-100	13-30	<25	NP-7
Reagan:											
ReA, ReB	0-29	Silty clay loam	CL	A-6, A-7-6	0	95-100	95-100	90-100	70-95	35-45	18-28
	29-80	Silty clay, silty clay loam, loam. clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	65-95	35-50	18-30
Rioconcho:											
Ro	0-80	Silty clay, silty clay loam.	CL, CH	A-6, A-7-6	0-10	85-100	83-100	75-100	70-97	39-62	20-38
Slaughter:											
ScA	0-8	Clay loam	CL	A-6	0	100	100	85-100	55-75	28-40	11-20
	8-18	Clay loam, clay	CL	A-6, A-7-6	0	95-100	95-100	90-100	65-90	35-50	17-30
	18-20	Variable, indurated, caliche.									
Springer:											
SpB	0-17	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4, A-3	0	98-100	95-100	70-96	8-25	<22	NP-4
	17-80	Fine sandy loam	SM, SM-SC	A-2-4	0	98-100	95-100	75-99	11-35	18-25	2-7
Tobosa:											
ToA	0-56	Clay	CH	A-7-6	0-5	80-100	75-100	75-100	75-98	51-72	30-45
	56-65	Clay, silty clay silty clay loam	CH, CL	A-7-6	0-5	80-100	75-100	75-100	70-95	45-65	25-40

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Acuff:										
AcA	0-8	0.6-2.0	0.12-0.18	6.6-7.8	Low	Moderate	Low	0.28	5	5
	8-45	0.6-2.0	0.14-0.19	7.4-8.4	Low	Moderate	Low	0.32		
	45-80	0.6-2.0	0.10-0.16	7.9-8.4	Low	Moderate	Low	0.32		
Amarillo:										
AmA, AmB	0-8	2.0-6.0	0.11-0.15	6.6-7.8	Low	Low	Low	0.24	5	3
	8-52	0.6-2.0	0.14-0.18	7.4-8.4	Low	Moderate	Low	0.32		
	52-80	0.6-2.0	0.10-0.15	7.9-8.4	Low	Moderate	Low	0.32		
Angelo:										
AnA, AnB	0-8	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low	0.32	4	6
	8-26	0.2-0.6	0.14-0.20	7.9-8.4	High	High	Low	0.32		
	26-80	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low	0.32		
Arvana:										
ArB	0-9	2.0-6.0	0.11-0.15	6.6-8.4	Low	Low	Low	0.24	2	3
	9-28	0.6-2.0	0.12-0.18	7.4-8.4	Low	Moderate	Low	0.32		
	28-40									
	40-70									
Bippus:										
BcA	0-24	0.6-2.0	0.14-0.20	7.4-8.4	Moderate	Moderate	Low	0.28	5	6
	24-62	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low	0.28		
Blakeney:										
BfB	0-13	2.0-6.0	0.08-0.15	7.9-8.4	Low	Moderate	Low	0.24	1	3
	13-35									
	35-60									
Broome:										
BrB	0-7	0.6-2.0	0.12-0.18	7.9-8.4	Moderate	Moderate	Low	0.37	5	6
	7-36	0.6-2.0	0.10-0.15	7.9-8.4	Moderate	Moderate	Low	0.37		
	36-70	0.6-2.0	0.12-0.18	7.9-8.4	Moderate	Moderate	Low	0.49		
Conger:										
CnC	0-18	0.6-2.0	0.10-0.18	7.9-8.4	Low	Moderate	Low	0.28	1	4L
	18-35									
	35-70									
Cottonwood:										
[1]COD	0-7	0.6-2.0	0.11-0.18	7.9-8.4	Low	High	Moderate	0.32	1	4L
	7-20									
Ector:										
[1]ECD	0-9	0.6-2.0	0.05-0.12	7.9-8.4	Very low	High	Low	0.28	1	8
	9-40									
Estacado:										
EsA	0-16	0.6-2.0	0.14-0.19	7.9-8.4	Low	Moderate	Low	0.28	5	4L
	16-25	0.6-2.0	0.12-0.18	7.9-8.4	Low	Moderate	Low	0.32		
	25-80	0.6-2.0	0.10-0.18	7.9-8.4	Low	Moderate	Low	0.32		
Lipan:										
Lc, Ls	0-55	<0.06	0.13-0.18	7.4-8.4	Very high	High	Low	0.32	5	4
	55-70	<0.06	0.13-0.18	7.9-8.4	Very high	High	Low	0.32		
Mereta:										
MeB	0-17	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	High	Low	0.32	2	6
	17-35									
	35-60									
Midessa:										
MfA, MfB, MfC	0-9	2.0-6.0	0.10-0.15	7.9-8.4	Low	Moderate	Low	0.24	3	3
	9-34	0.6-2.0	0.12-0.18	7.9-8.4	Low	Moderate	Low	0.32		
	34-80	0.6-2.0	0.10-0.16	7.9-8.4	Low	Moderate	Low	0.32		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Monahans:										
MoC----------------	0-6	2.0-6.0	0.09-0.15	7.9-8.4	Low--------	Moderate	Moderate	0.24	3	3
	6-17	0.6-2.0	0.10-0.16	7.9-8.4	Low--------	Moderate	Moderate	0.28		
	17-60	0.6-2.0	0.07-0.14	7.9-8.4	Low--------	High------	Moderate	0.28		
Patricia:										
PaB----------------	0-14	6.0-20	0.04-0.10	6.6-7.8	Very low	Low-------	Low-------	0.10	5	2
	14-80	0.6-2.0	0.12-0.18	6.6-8.4	Low--------	Moderate	Low-------	0.24		
Potter:										
[1]PoD---------------	0-7	0.6-2.0	0.10-0.16	7.9-8.4	Low--------	Moderate	Low-------	0.28	1	8
	7-30	0.6-6.0	0.00-0.06	7.9-8.4	Low--------	Moderate	Low-------	---		
Pyote:										
PyC----------------	0-26	6.0-20	0.03-0.09	6.6-7.8	Very low	Low-------	Low-------	0.10	5	1
	26-80	2.0-6.0	0.08-0.14	7.4-8.4	Low--------	Low-------	Low-------	0.17		
Reagan:										
ReA, ReB-----------	0-29	0.6-2.0	0.15-0.20	7.9-8.4	Moderate	Moderate	Low-------	0.32	5	4L
	29-80	0.6-2.0	0.10-0.16	7.9-8.4	Moderate	Moderate	Low-------	0.32		
Rioconcho:										
Ro-----------------	0-80	0.06-0.2	0.15-0.20	7.4-8.4	High-------	High------	Low-------	0.32	5	6
Slaughter:										
ScA----------------	0-8	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low-------	0.32	1	6
	8-18	0.2-0.6	0.13-0.19	6.6-8.4	Moderate	Moderate	Low-------	0.37		
	18-20									
Springer:										
SpB----------------	0-17	6.0-20	0.06-0.10	6.6-7.8	Very low	Low-------	Low-------	0.17	5	2
	17-80	2.0-6.0	0.10-0.15	6.6-8.4	Low--------	Low-------	Low-------	0.20		
Tobosa:										
ToA----------------	0-56	<0.06	0.12-0.18	7.4-8.4	Very high	High------	Low-------	0.32	4	4
	56-65	<0.06	0.10-0.18	7.9-8.4	Very high	High------	Low-------	---		

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 14.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness
					In		In	
Acuff: AcA	B	None	---	---	>60	---	---	---
Amarillo: AmA, AmB	B	None	---	---	>60	---	---	---
Angelo: AnA, AnB	C	None	---	---	>60	---	---	---
Arvana: ArB	C	None	---	---	>60	---	20-40	Rippable.
Bippus: BcA	B	None to common.	Very brief	Apr-Oct	>60	---	---	---
Blakeney: BfB	C	None	---	---	>60	---	12-20	Rippable.
Broome: BrB	B	None	---	---	>60	---	---	---
Conger: CnC	C	None	---	---	>60	---	12-20	Rippable.
Cottonwood: [1]COD	C	None	---	---	3-12	Rippable.	---	---
Ector: [1]ECD	D	None	---	---	4-20	Hard	---	---
Estacado: EsA	B	None	---	---	>60	---	---	---
Lipan: Lc, Ls	D	Rare to common.	Long to very long.	Apr-Jun	>60	---	---	---
Mereta: MeB	C	None	---	---	>60	---	14-20	Rippable.
Midessa: MfA, MfB, MfC	B	None	---	---	>60	---	---	---
Monahans: MoC	B	None	---	---	>60	---	---	---
Patricia: PaB	B	None	---	---	>60	---	---	---
Potter: [1]PoD	C	None	---	---	>60	---	---	---
Pyote: PyC	A	None	---	---	>60	---	---	---
Reagan: ReA, ReB	B	None	---	---	>60	---	---	---

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness
					In		In	
Rioconcho:								
Ro	C	Rare to common.	Very brief to brief.	Apr-Jun	>60	---	---	---
Slaughter:								
ScA	C	None	---	---	>60	---	9-20	Rip-pable.
Springer:								
SpB	B	None	---	---	>60	---	---	---
Tobosa:								
ToA	D	None	---	---	>60	---	---	---

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 15.--ENGINEERING TEST DATA

[Tests performed by Texas Highway Department in accordance with standard procedures of the American Association of State Highway and Transportation Officials (AASHTO)]

Soil name	Texas report No.	Depth	Shrinkage			Mechanical analysis[1]								Liquid limit	Plasticity index	Classification[2]	
						Percentage passing sieve--					Percentage smaller than--						
			Limit	Linear	Ratio	No. 4	No. 10	No. 40	No. 60	No. 200	0.05 mm	0.005 mm	0.002 mm			AASHTO[3]	Unified[4]
		In	Pct	Pct										Pct			
Angelo, silty clay loam:	72-163-R	0-8	16	14.3	1.84	100	100	100	99	89	73	28	16	48	27	A-7-6(16)	CL
in a pasture 20 feet west	72-164-R	8-16	15	15.3	1.92	100	100	100	100	92	79	42	30	49	30	A-7-6(18)	CL
of county road; 2.05 miles	72-165-R	16-26	15	14.8	1.93	100	100	100	100	92	50	48	35	47	29	A-7-6(17)	CL
north of Texas Highway	72-166-R	34-47	19	8.7	1.75	99	98	97	96	88	79	54	39	38	19	A-6(12)	CL
158; 7.6 miles southeast																	
of Garden City, Texas, on																	
Texas Highway 158.																	
Reagan, silty clay loam:	72-172-R	4-9	16	10.8	1.81	100	99	98	97	84	67	26	16	39	21	A-6(12)	CL
in a pasture 0.25 miles	72-173-R	9-19	15	12.4	1.86	100	99	98	97	88	73	37	28	42	25	A-7-6(14)	CL
east of Texas Highway 137;	72-174-R	19-29	16	12.5	1.86	100	100	99	98	90	89	50	38	42	25	A-7-6(14)	CL
9.85 miles south of the	72-175-R	29-52	14	10.7	1.93	100	99	98	97	89	80	54	42	35	21	A-6(12)	CL
intersection of Texas																	
Highway 137 and Texas																	
Highway 158.																	
Rioconcho, silty clay loam:	72-167-R	0-16	17	14.5	1.82	100	100	100	100	92	79	33	21	50	29	A-7-6(18)	CL, CH
in a pasture 50 feet east	72-168-R	16-42	13	18.8	1.93	100	100	100	100	95	87	54	41	57	37	A-7-6(19)	CH
of a ranch road; 7.6 miles	72-169-R	42-52	14	18.0	1.94	100	100	100	100	94	84	48	35	56	37	A-7-6(19)	CH
southeast of Garden City,	72-170-R	52-62	13	19.0	1.98	100	100	100	100	97	88	53	40	57	38	A-7-6(19)	CH
Texas, on Texas Highway	72-171-R	62-84	14	17.8	1.95	100	99	99	99	96	89	47	33	55	35	A-7-6(10)	CH
158; 0.9 miles south on																	
ranch road.																	

[1]Mechanical analyses according to the AASHTO Designation T88 (1). Results by this procedure may differ somewhat from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses data used in this table are not suitable for use in naming textural classes for soil.

[2]Unified and AASHTO Classification made by Soil Conservation Service personnel.

[3]Based on AASHTO Designation M 145-49 (1).

[4]Based on the Unified soil classification system (2).

TABLE 16.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Acuff	Fine-loamy, mixed, thermic Aridic Paleustolls
Amarillo	Fine-loamy, mixed, thermic Aridic Paleustalfs
Angelo	Fine, mixed, thermic Torrertic Calciustolls
Arvana	Fine-loamy, mixed, thermic Petrocalcic Paleustalfs
Bippus	Fine-loamy, mixed, thermic Cumulic Haplustolls
Blakeney	Loamy, mixed, thermic, shallow Ustochreptic Paleorthids
Broome	Fine-silty, mixed, thermic Calciorthidic Paleustalfs
Conger	Loamy, mixed, thermic, shallow Ustollic Paleorthids
Cottonwood	Loamy, mixed, (calcareous), thermic, shallow Ustic Torriorthents
Ector	Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Estacado	Fine-loamy, mixed, thermic Calciorthidic Paleustolls
Lipan	Fine, montmorillonitic, thermic Entic Pellusterts
Mereta	Clayey, mixed, thermic, shallow Petrocalcic Calciustolls
Midessa	Fine-loamy, mixed, thermic Aridic Ustochrepts
*Monahans	Coarse-loamy, mixed, thermic Typic Camborthids
Patricia	Fine-loamy, mixed, thermic Aridic Paleustalfs
Potter	Loamy, carbonatic, thermic, shallow Ustollic Calciorthids
*Pyote	Loamy, mixed, thermic Arenic Ustalfic Haplargids
Reagan	Fine-silty, mixed, thermic Ustollic Calciorthids
Rioconcho	Fine, mixed, thermic Vertic Haplustolls
Slaughter	Clayey, mixed, thermic, shallow Petrocalcic Paleustolls
Springer	Coarse-loamy, mixed, thermic Udic Paleustalfs
Tobosa	Fine, montmorillonitic, thermic Typic Chromusterts

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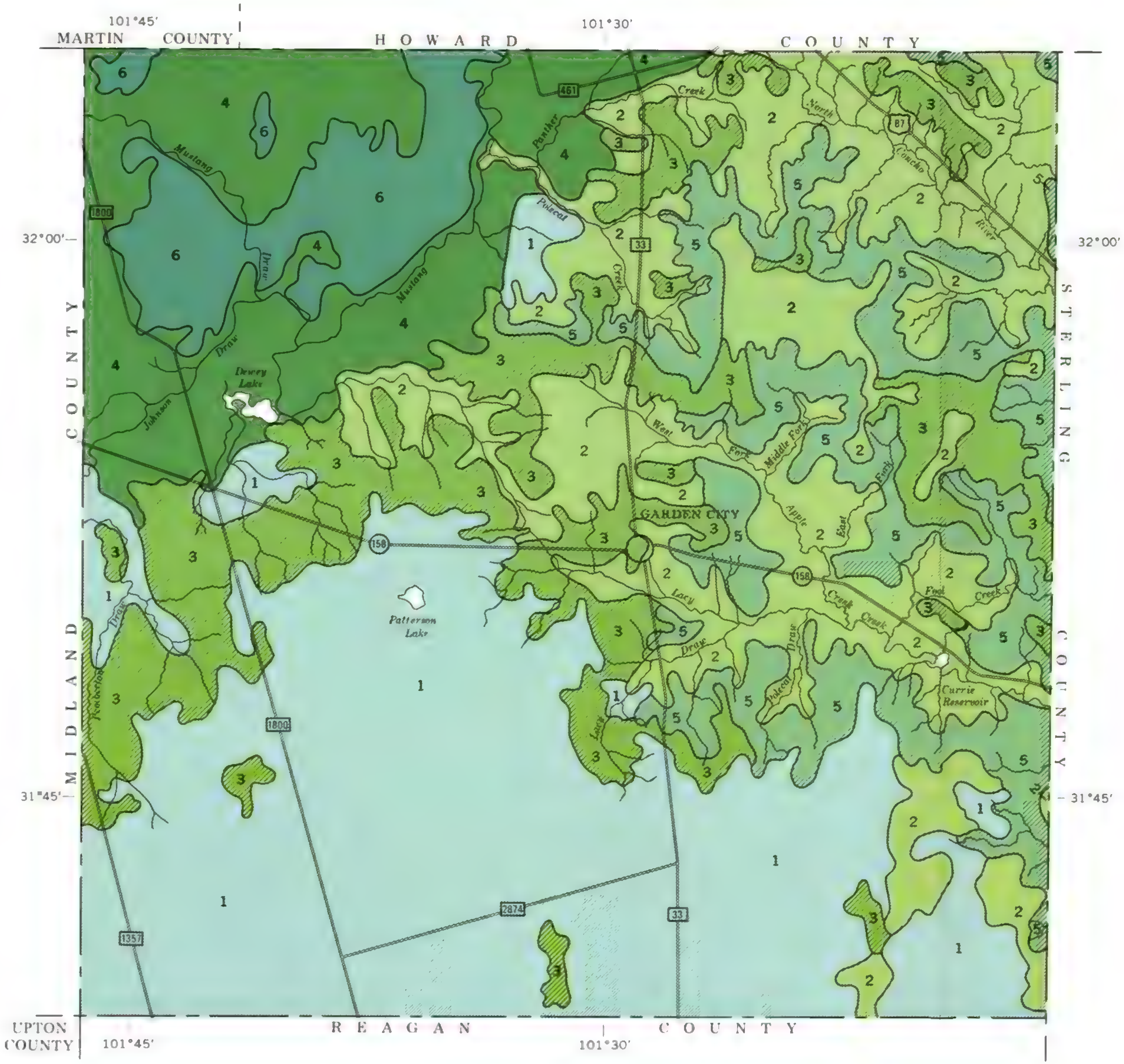


SOIL ASSOCIATIONS

1 Reagan association: Deep, nearly level and gently sloping, calcareous, loamy soils on uplands.

2 Angelo-Rioconcho association: Deep, nearly level and gently sloping, calcareous, loamy and clayey soils on uplands and bottom lands.

3 Conger association: Shallow, gently sloping, calcareous, loamy soils on uplands.

4 Amarillo-Midessa association: Deep, nearly level and gently sloping, noncalcareous and calcareous, loamy soils on uplands.

5 Ector association: Very shallow and shallow, gently sloping to steep, calcareous, loamy soils on uplands.

6 Patricia-Pyote association: Deep, nearly level and gently sloping, noncalcareous, sandy soils on uplands.

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Compiled 1976

N

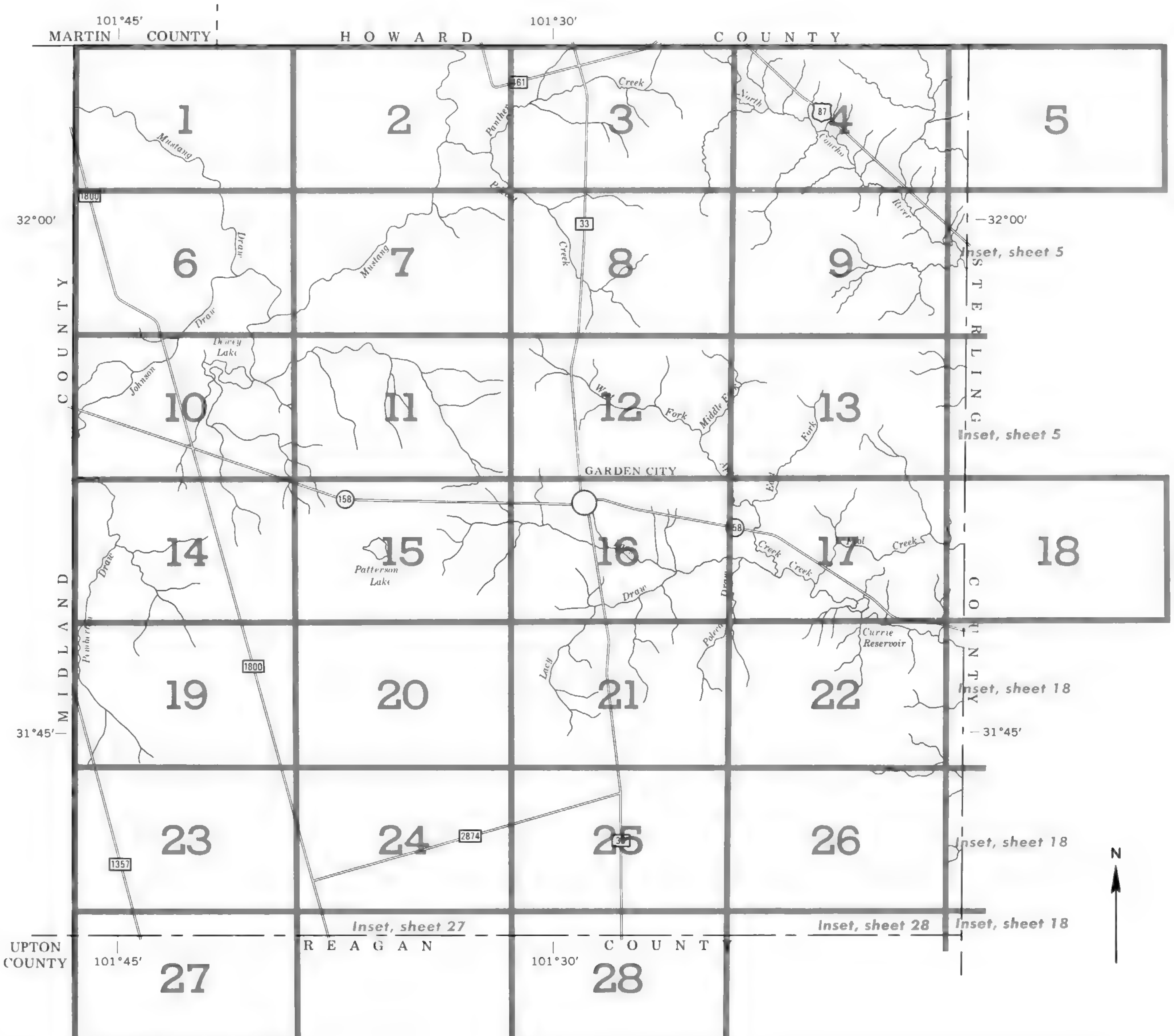
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

GLASSCOCK COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles



INDEX TO MAP SHEETS

GLASSCOCK COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a lower case letter for a narrowly defined unit, and a capital letter for a broadly defined unit. Consecutive capital letters in the map symbols indicate the delineations are larger, and the compositon of the unit is apt to be more variable than the other units in the survey area. The last capital letter, A, B, C, D, or E, shows the slope. Map symbols without a slope letter are those of nearly level soils. (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in some places, but the degree of erosion cannot be estimated reliably.

SYMBOL	NAME
AcA	Acuff loam, 0 to 1 percent slopes
AmA	Amarillo fine sandy loam, 0 to 1 percent slopes (W)
AmB	Amarillo fine sandy loam, 1 to 3 percent slopes (W)
AnA	Angelo silty clay loam, 0 to 1 percent slopes
AnB	Angelo silty clay loam, 1 to 3 percent slopes
ArB	Arvana fine sandy loam, 1 to 3 percent slopes (W)
BcA	Bippus clay loam, 0 to 1 percent slopes
BfB	Blakeney fine sandy loam, 1 to 3 percent slopes
BrB	Broome clay loam, 1 to 3 percent slopes
CnC	Conger clay loam, 1 to 5 percent slopes
COD	Cottonwood association, undulating
ECD	Ector association, undulating
EsA	Estacado clay loam, 0 to 1 percent slopes
Lc	Lipan clay, depressional
Ls	Lipan stony clay
MeB	Mereta clay loam, 1 to 3 percent slopes
MfA	Midessa fine sandy loam, 0 to 1 percent slopes (W)
MfB	Midessa fine sandy loam, 1 to 3 percent slopes (W)
MfC	Midessa fine sandy loam, 3 to 5 percent slopes (W)
MoC	Monahans fine sandy loam, 1 to 5 percent slopes
PaB	Patricia loamy fine sand, 0 to 3 percent slopes (W)
PoD	Potter soils, 3 to 8 percent soils
PyC	Pyote fine sand, 0 to 5 percent slopes (W)
ReA	Reagan silty clay loam, 0 to 1 percent slopes
ReB	Reagan silty clay loam, 1 to 3 percent slopes
Ro	Rioconcho silty clay
ScA	Slaughter clay loam, 0 to 1 percent slopes
SpB	Springer loamy fine sand, 0 to 3 percent slopes (W)
ToA	Tobosa clay, 0 to 1 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — Int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CeA FoB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

1

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GLASSCOCK COUNTY, TEXAS NO. 1

GLASSCOCK COUNTY, TEXAS NO. 2

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3

N

GLASSCOCK COUNTY, TEXAS NO. 3

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 8)

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Scale 1:31 680

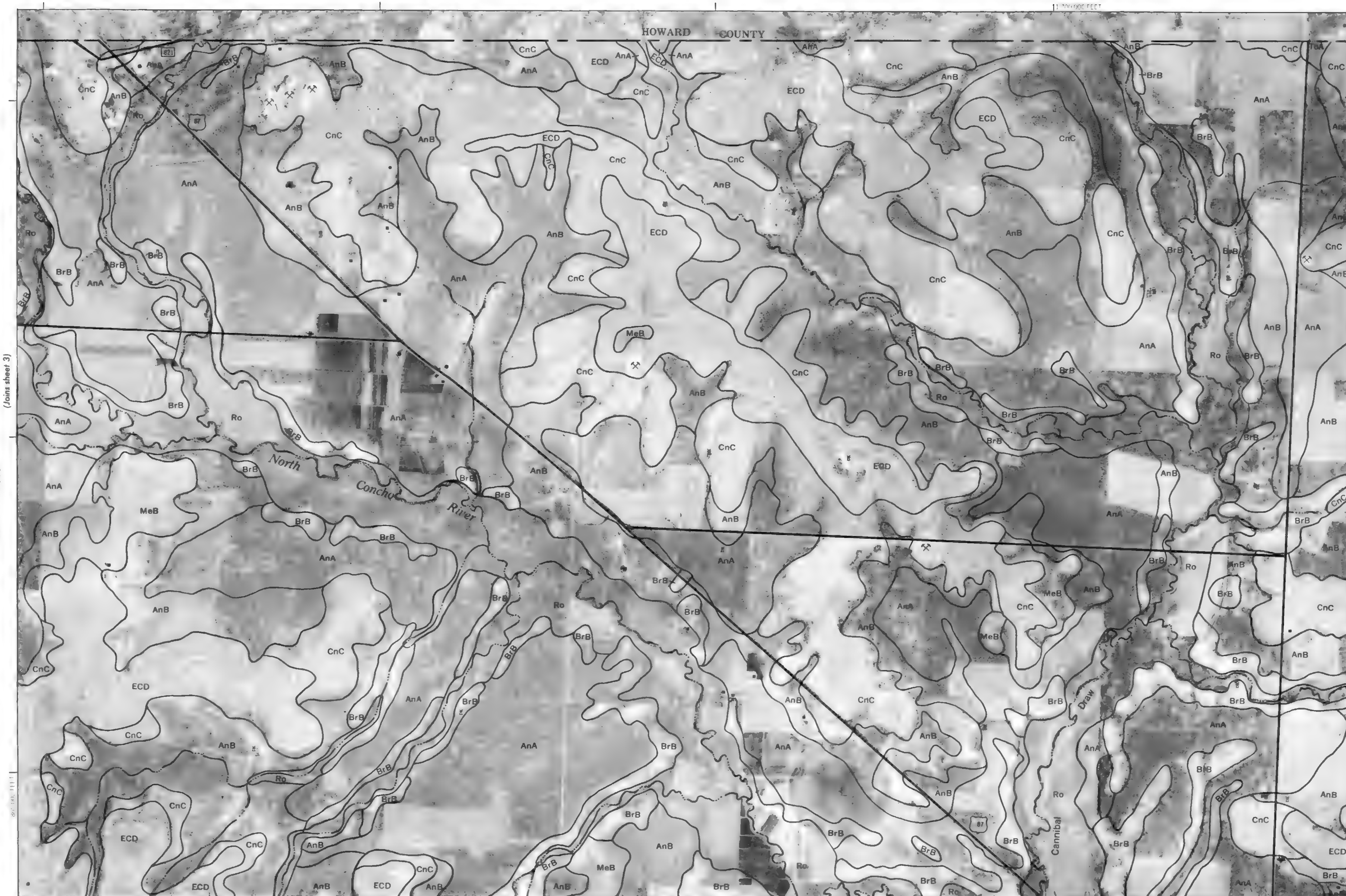
3 Miles

15 000 Feet

GLASSCOCK COUNTY, TEXAS — SHEET NUMBER 4

4

N



Scale 1:31 680

3 Miles

15 000 Feet

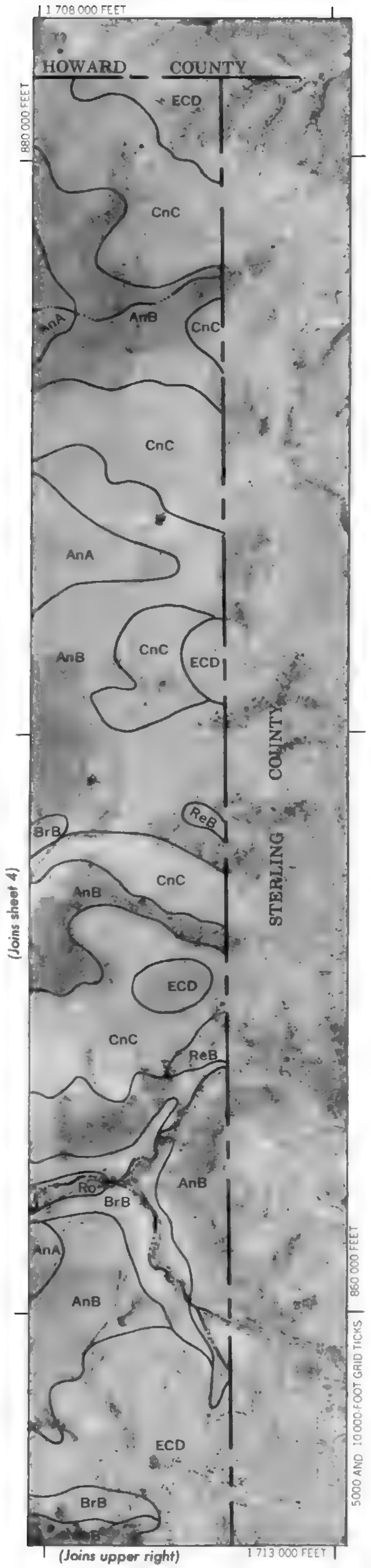
GLASSCOCK COUNTY, TEXAS NO. 4

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

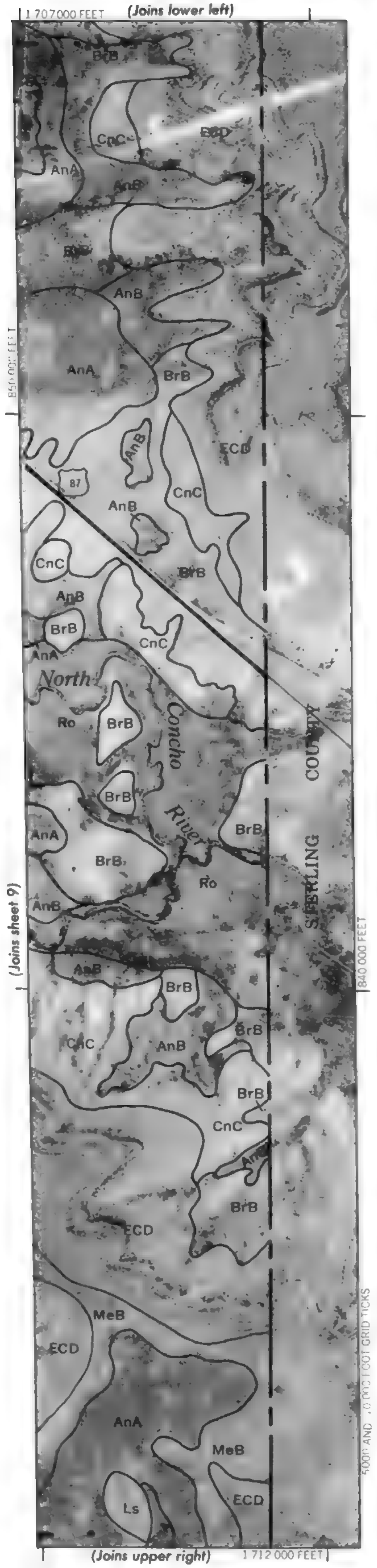
5

GLASSCOCK COUNTY, TEXAS NO. 5

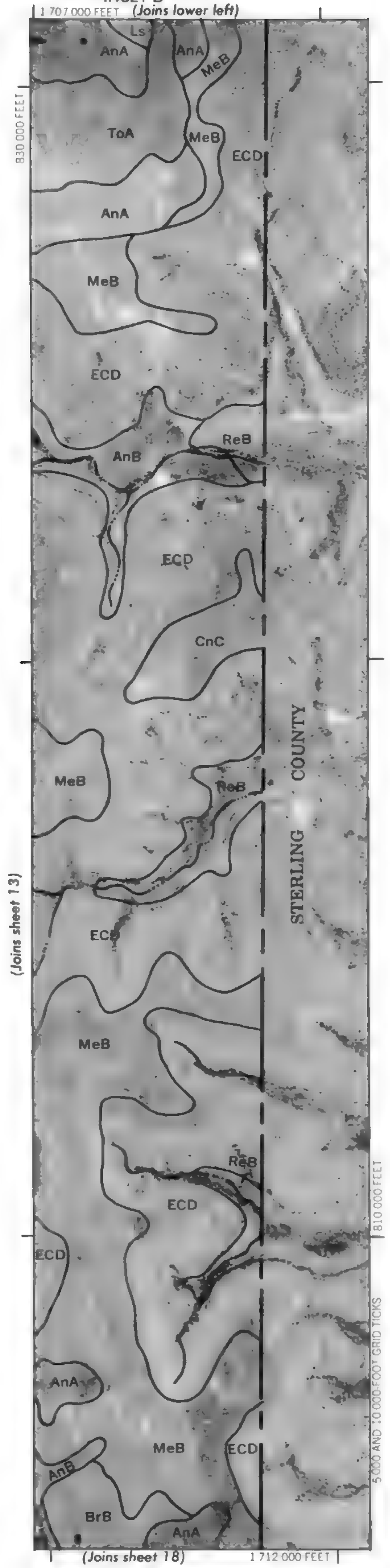
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land divisions or corners, if shown, are approximately positioned.



INSET A
(Joins lower left)



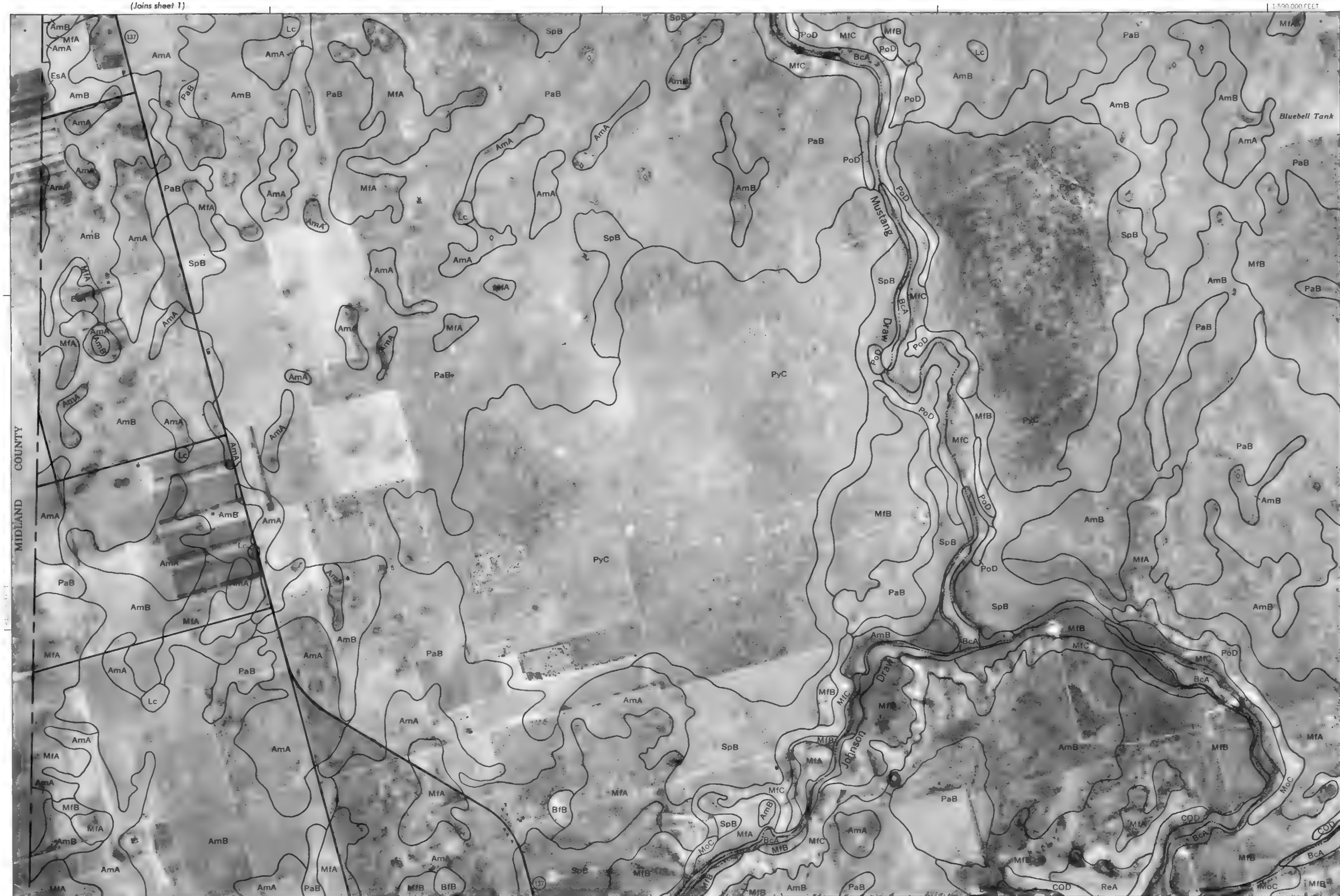
INSET B
(Joins lower left)



6

N

(Joins sheet 1)



(Joins sheet 7)

(Joins sheet 10)

Scale 1:31 680

3 Miles 2 1 0 1/4 1/2 3/4 1

15 000 Feet 10 000 5 000 0 1000 2000 3000 4000 5000

GLASSCOCK COUNTY, TEXAS NO. 6

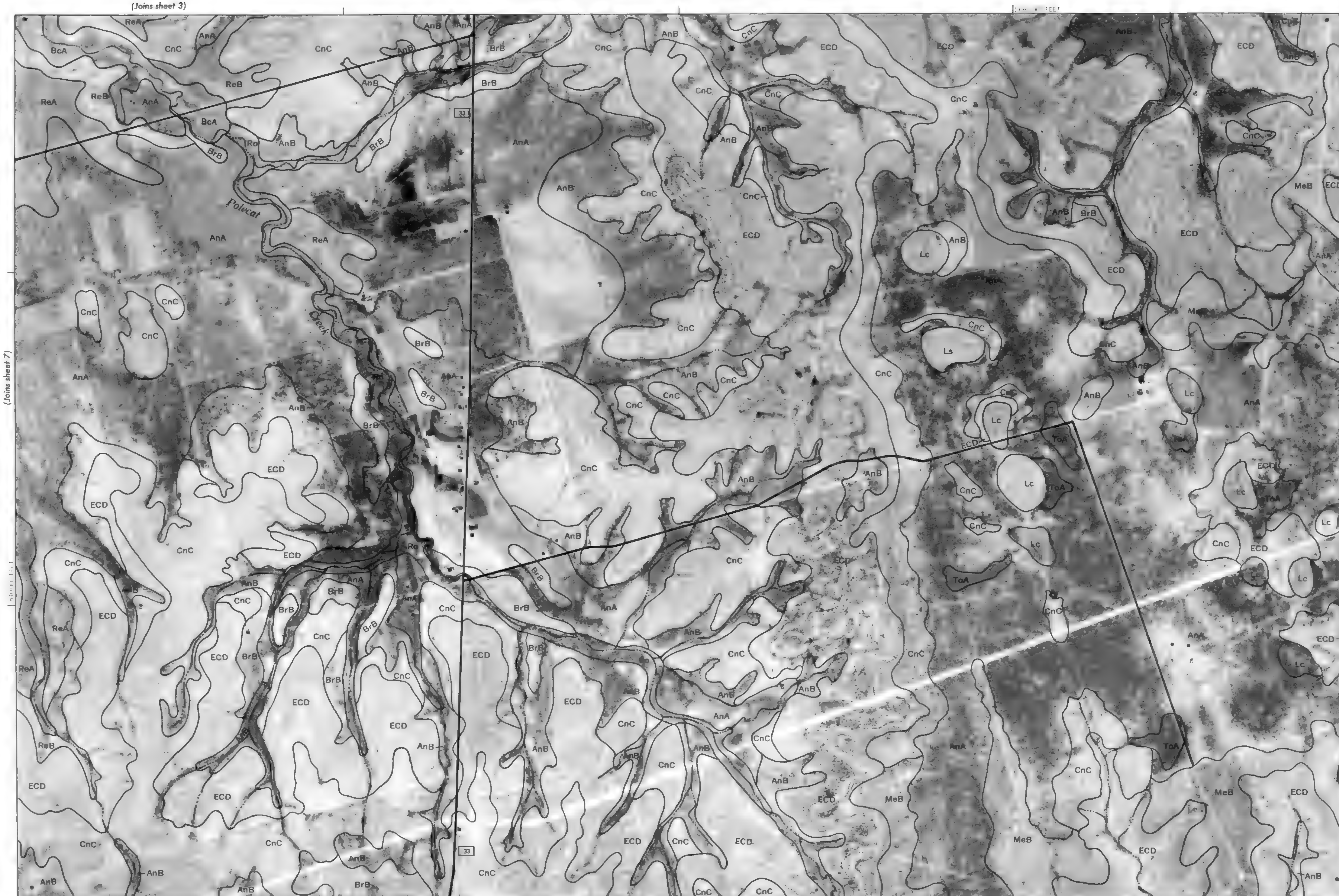
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


7
N
(Joins sheet 2)
(Joins sheet 8)
(Joins sheet 11)
(Joins sheet 6)
GLASSCOCK COUNTY, TEXAS NO. 7
1 600 000 FEET
850 000 FEET
Hogg Mountain
Big Tank
Salt Lake
Mustang
Draw
Scale 1:31 680
3 Miles
15 000 Feet
10 000
5000
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

8

N

(Joins sheet 3)



(Joins sheet 7)

(Joins sheet 9)

(Joins sheet 12)

Scale 1:31 680

3 Miles

2

1

0

15 000 Feet

10 000

5 000

0

1000

2000

3000

4000

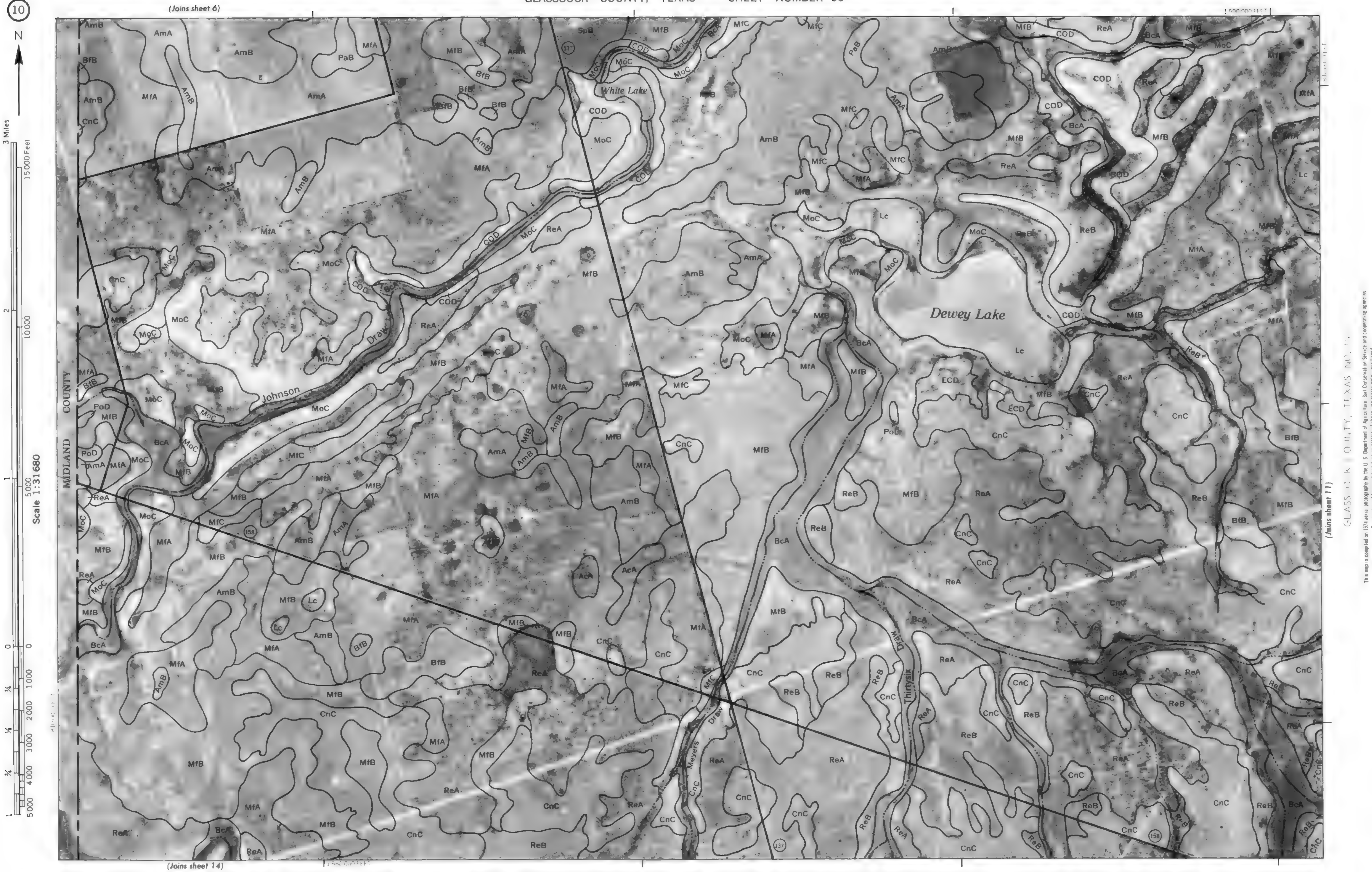
5000

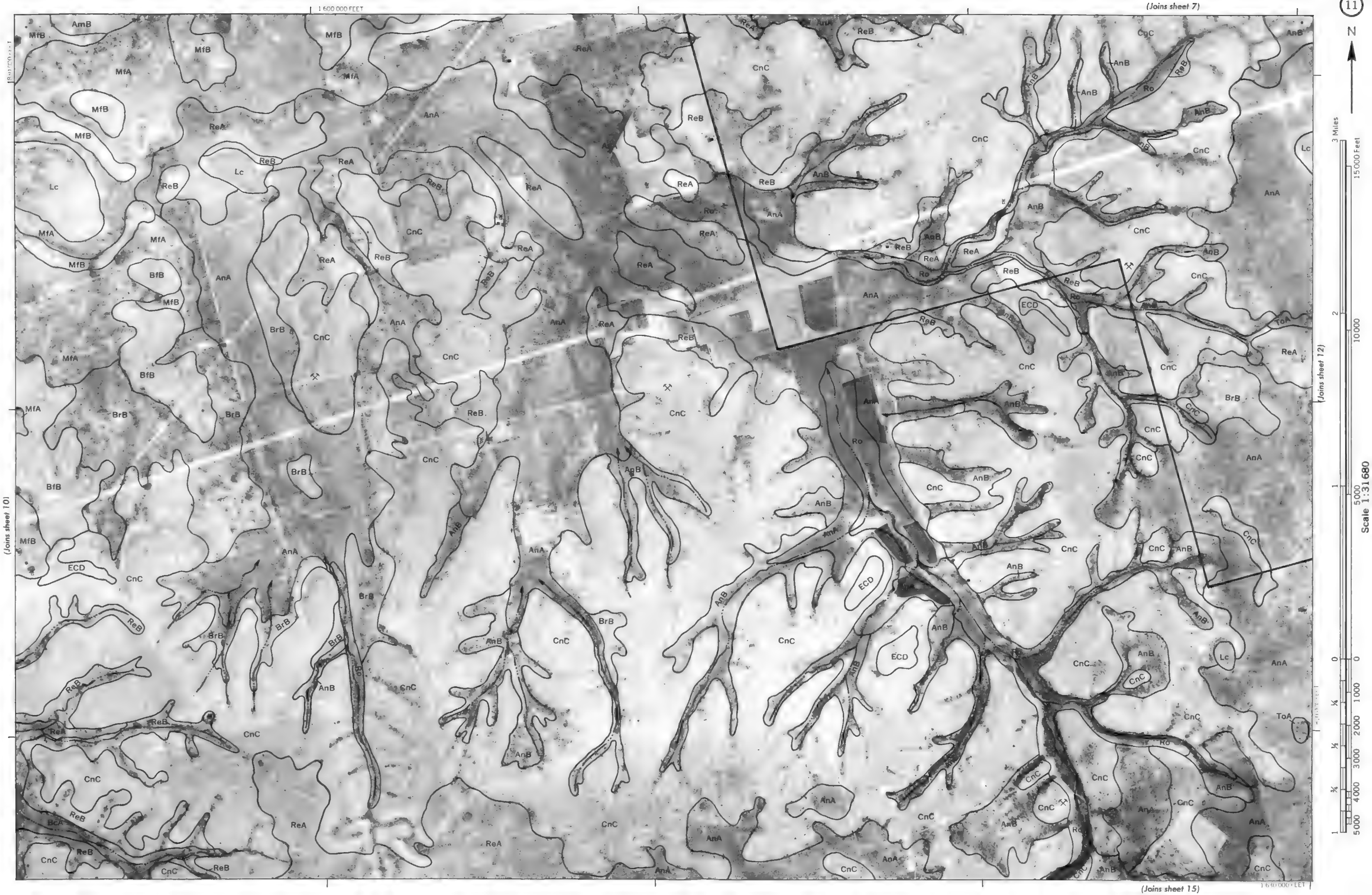
GLASSCOCK COUNTY, TEXAS NO. 8

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

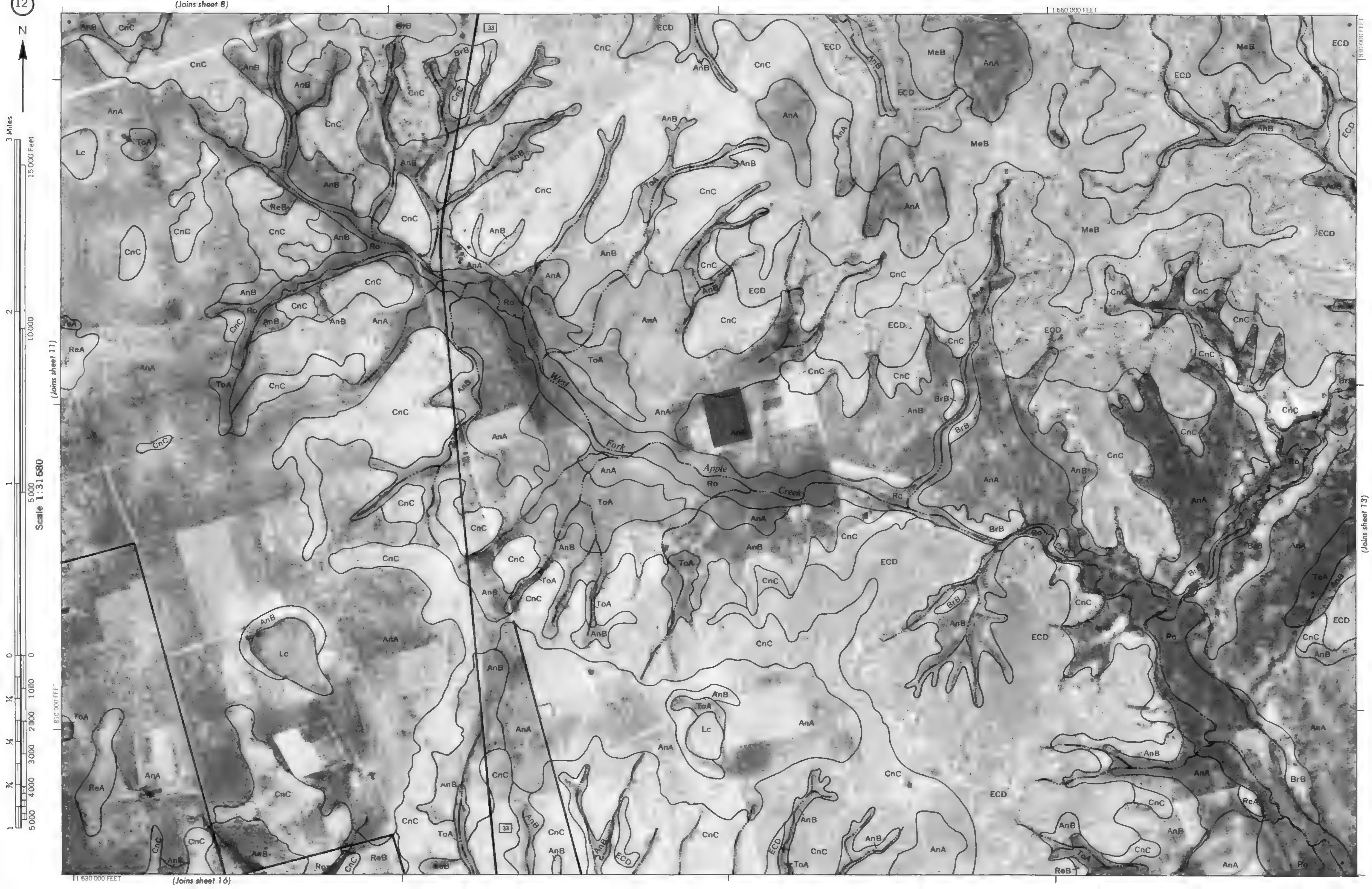
GLASSCOCK COUNTY, TEXAS NO. 9


10
N
(Joins sheet 6)
(Joins sheet 14)
(Joins sheet 11)
White Lake
Dewey Lake
Johnson Draw
Meyers Draw
Thirtysix Draw
MIDLAND COUNTY
Scale 1:31 680
3 Miles
15 000 Feet
10 000
5000
2
1
0
1000
2000
3000
4000
5000
137
158



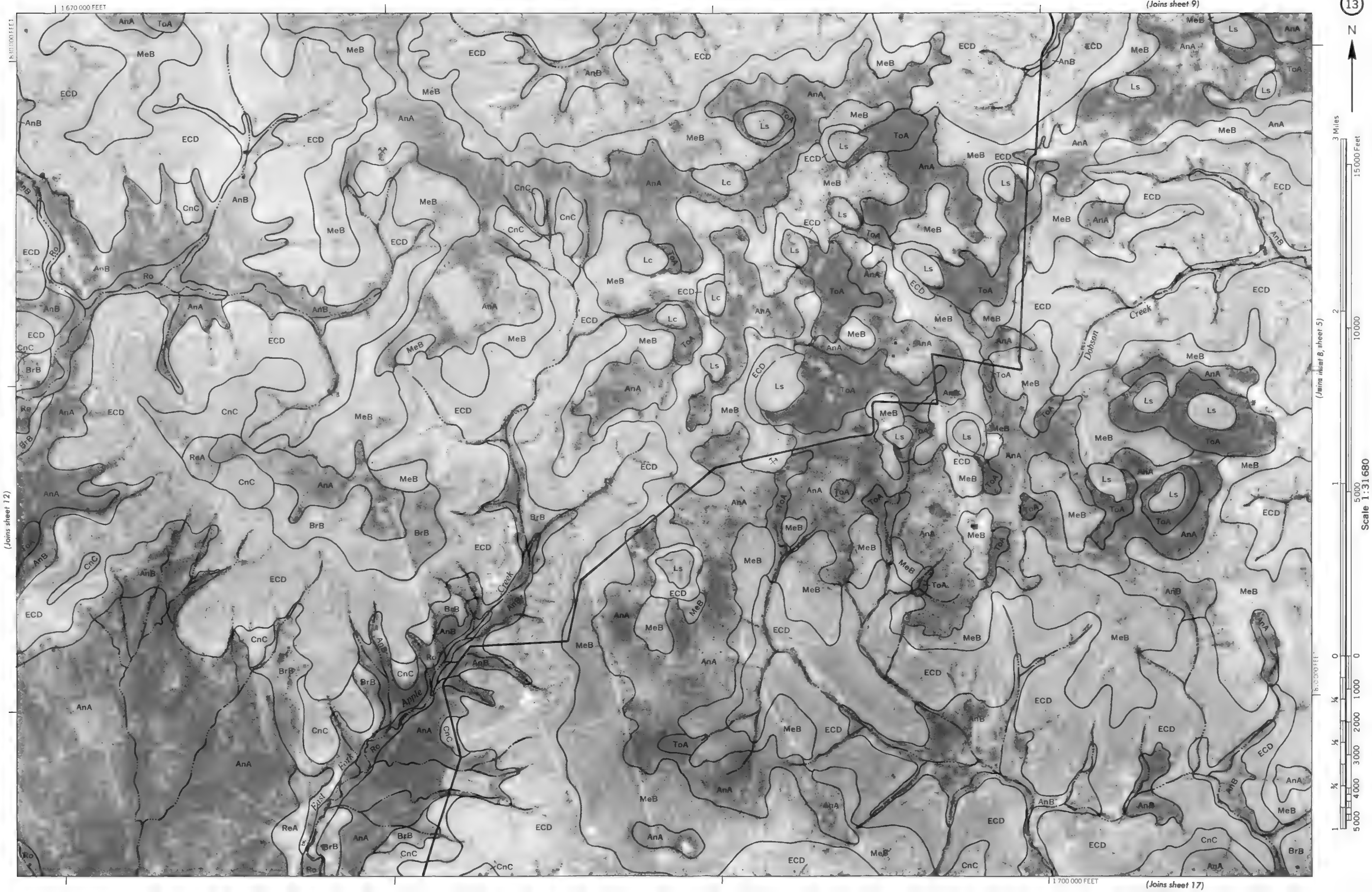
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GLASSCOCK COUNTY, TEXAS NO. 11



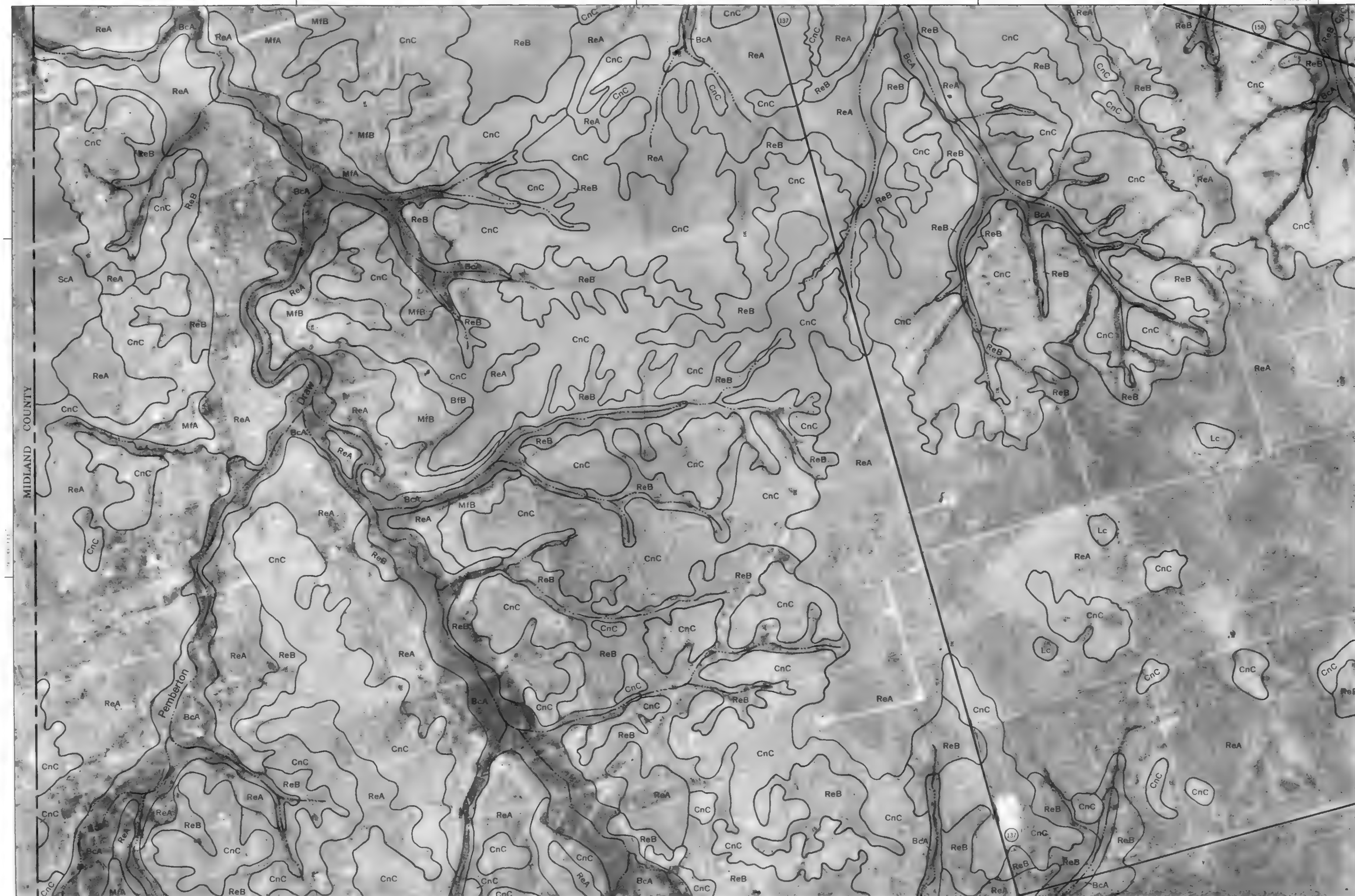
GLASSCOCK COUNTY, TEXAS NO. 12

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


13
N
(Joins sheet 9)
(Joins sheet 17)
(Joins sheet 12)
(Joins inset 8, sheet 5)
1 670 000 FEET
1 700 000 FEET
GLASSCOCK COUNTY, TEXAS NO. 1
Scale 1:31 680
3 Miles
15 000 Feet
10 000
5 000
2
1
0
1000
2000
3000
4000
5000
ECD
MeB
AnA
AnB
ToA
Ls
Lc
CnC
BrB
ReA
Ro
Dobson Creek
East Fork Apple Creek

(14)

(Joins sheet 10)



(Joins sheet 15)

(Joins sheet 19)

N

3 Miles

2

1

0

1

15 000 Feet

10 000

5 000

0

Scale 1:31 680

1000

2000

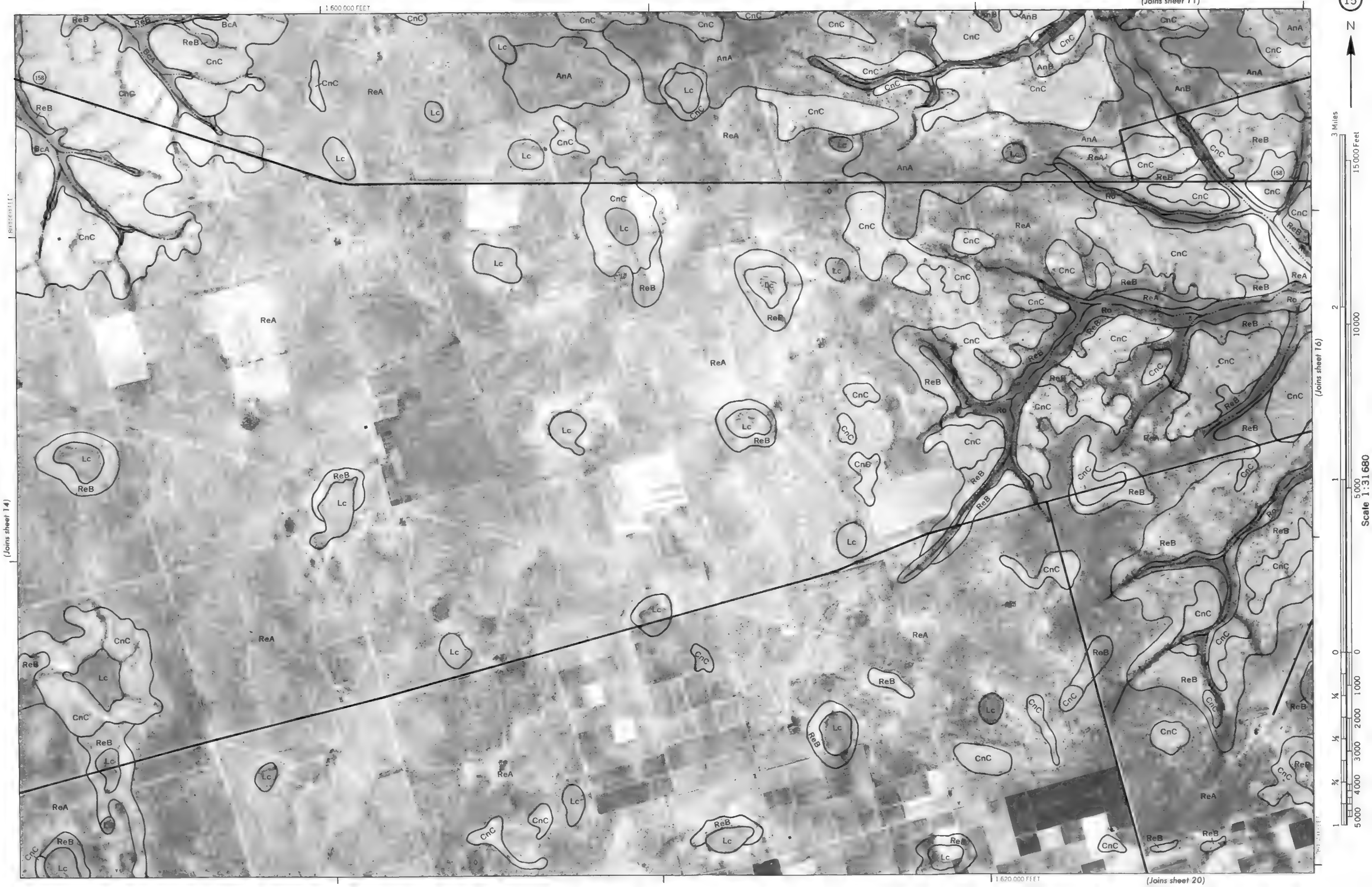
3000

4000

5000

GLASSCOCK COUNTY, TEXAS NO. 14

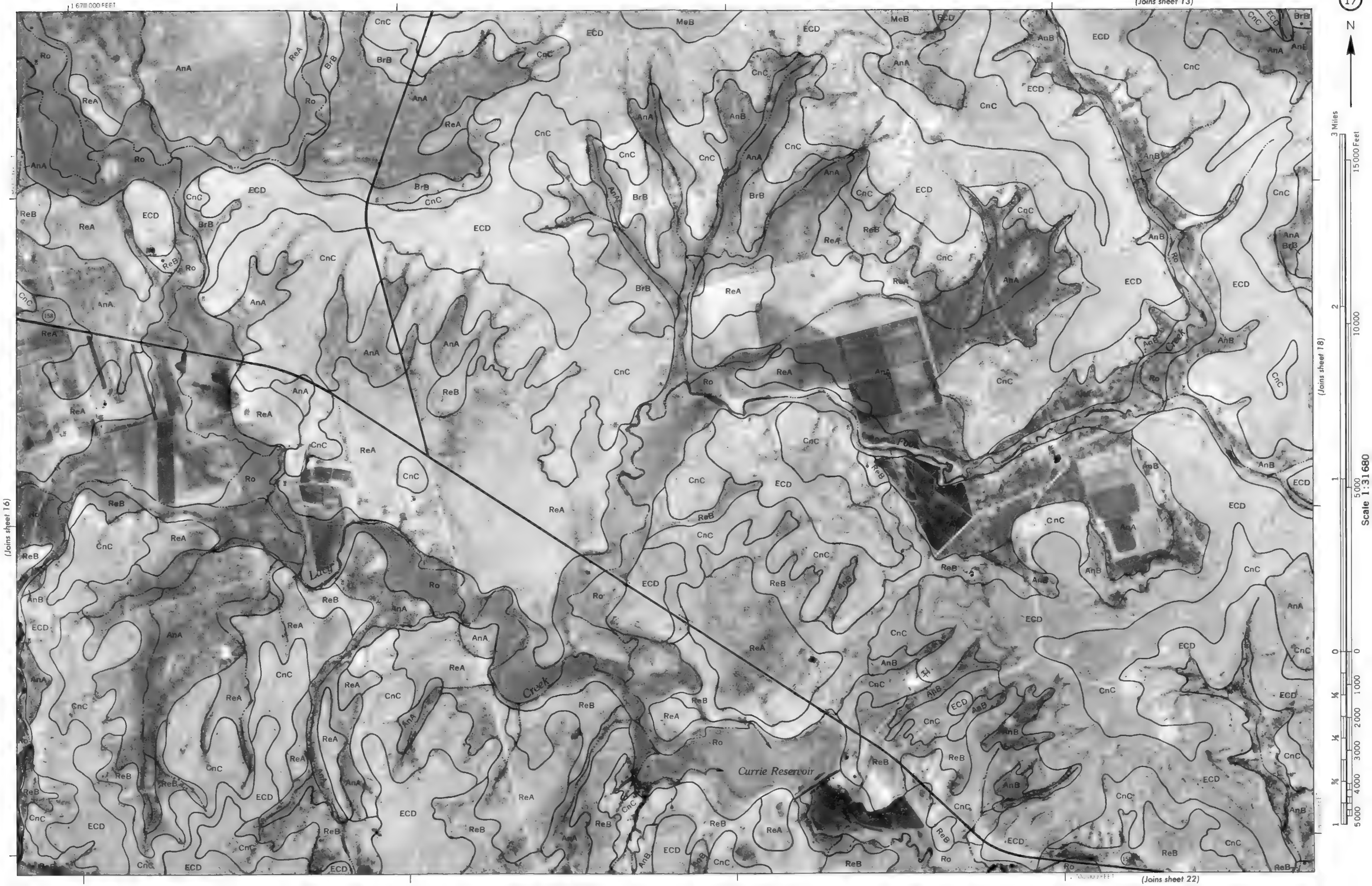
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



GLASSCOCK COUNTY, TEXAS NO. 15

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

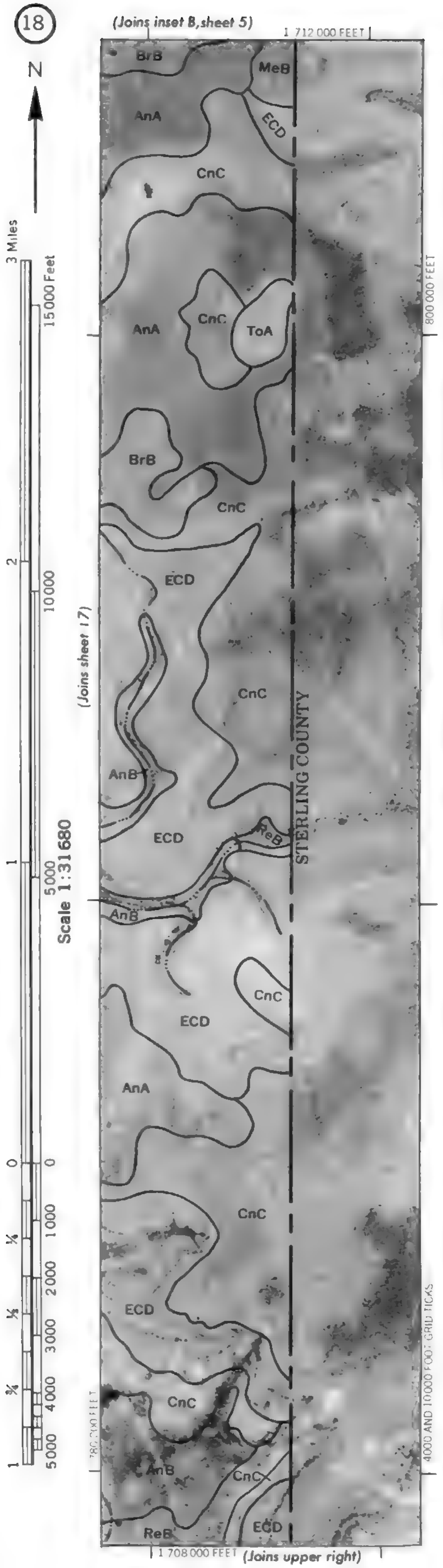
GLASSCOCK COUNTY, TEXAS — SHEET NUMBER 16

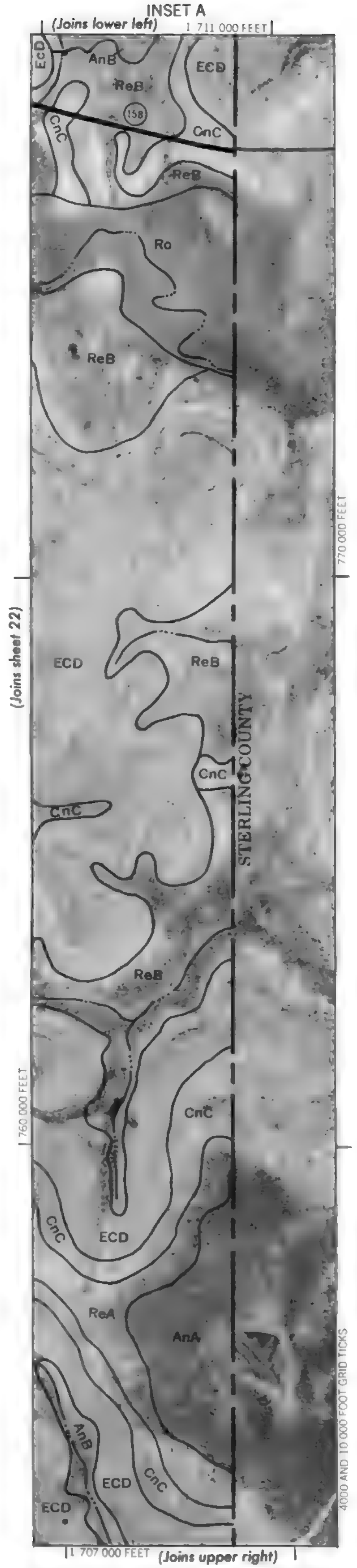


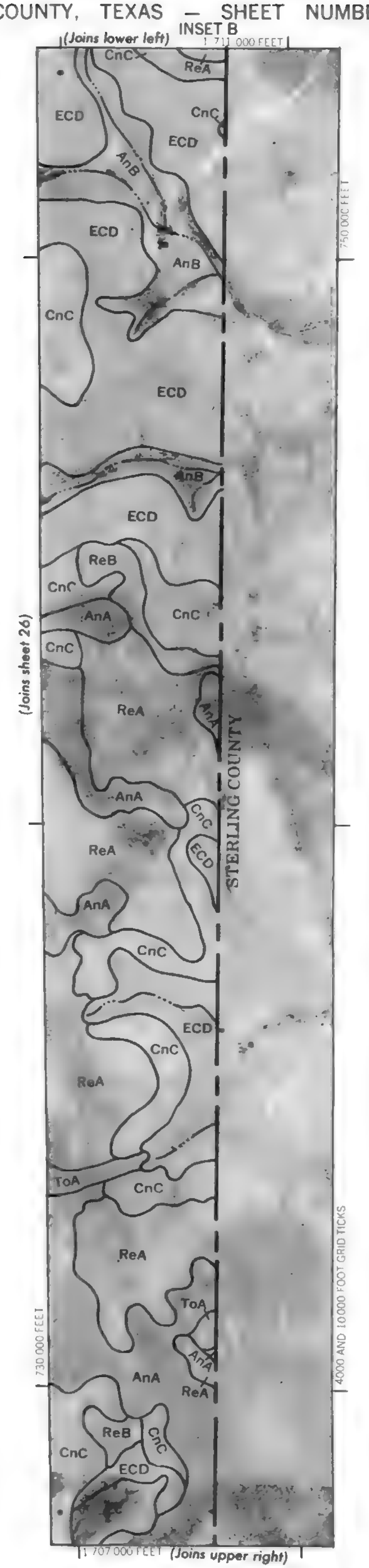
GLASSCOCK COUNTY, TEXAS NO. 17

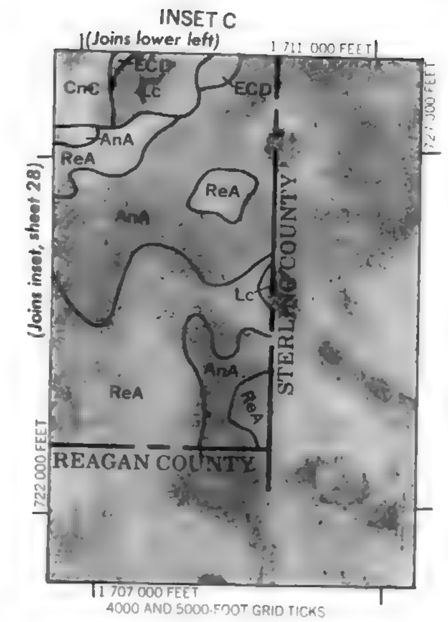
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GLASSCOCK COUNTY, TEXAS — SHEET NUMBER 18



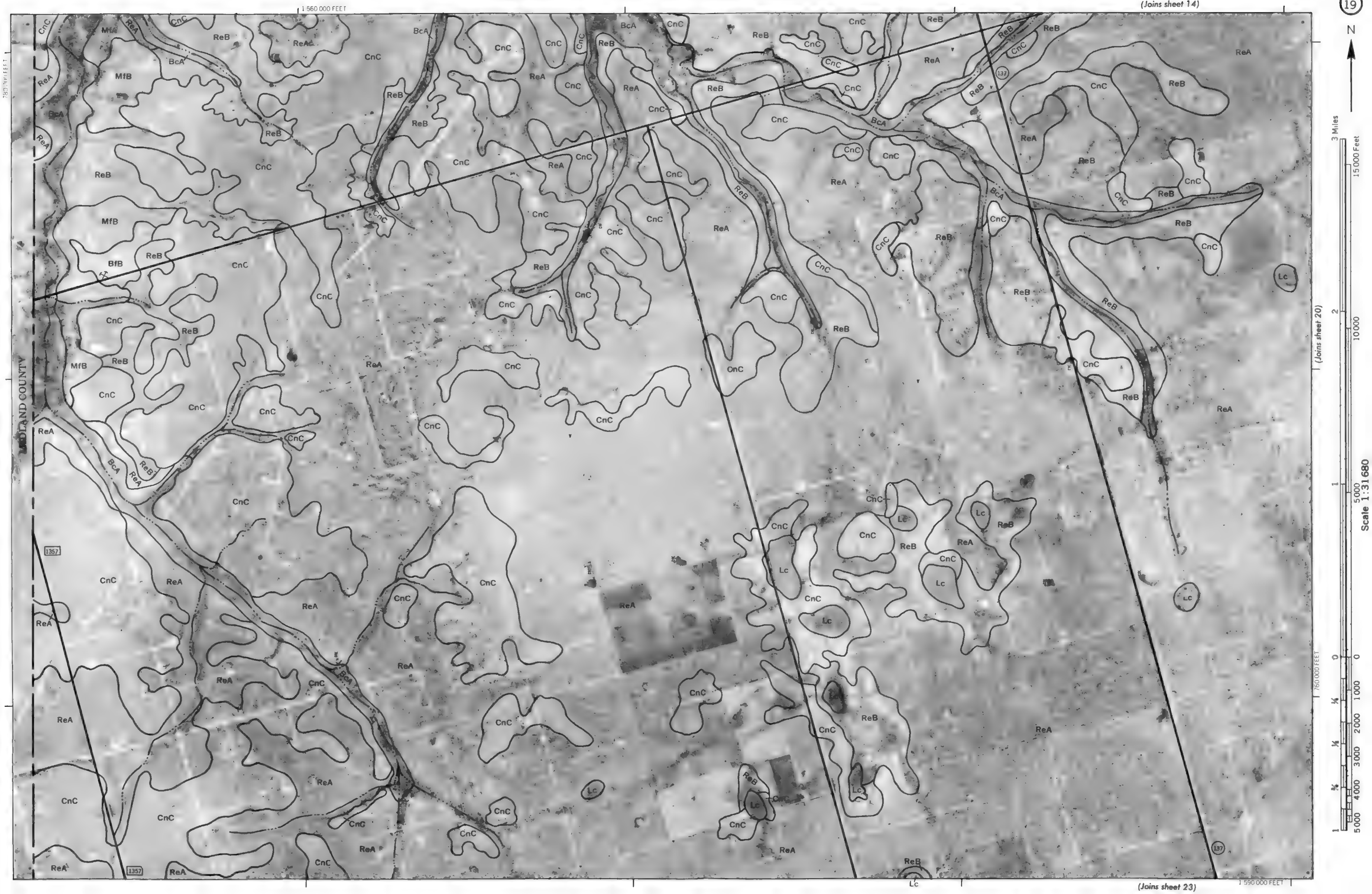






GLASSCOCK COUNTY, TEXAS NO. 18

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

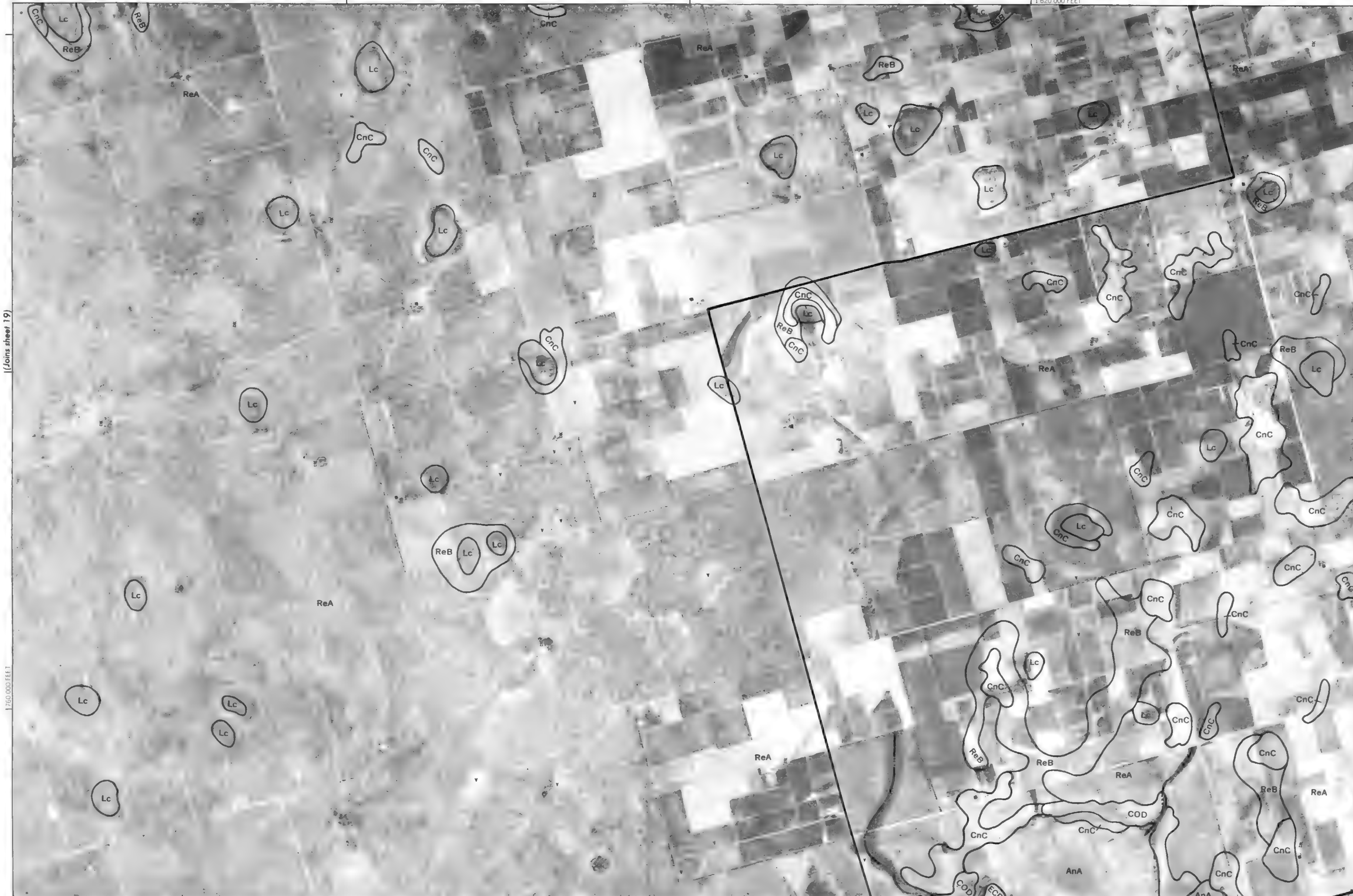
GLASSCOCK COUNTY, TEXAS NO. 19

20

N

(Joins sheet 15)

(Joins sheet 19)



(Joins sheet 21)

(Joins sheet 24)

Scale 1:31 680

3 Miles

2

1

0

15 000 Feet

10 000

5 000

0

1000

2000

3000

4000

5000

1

¼

½

¾

1

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

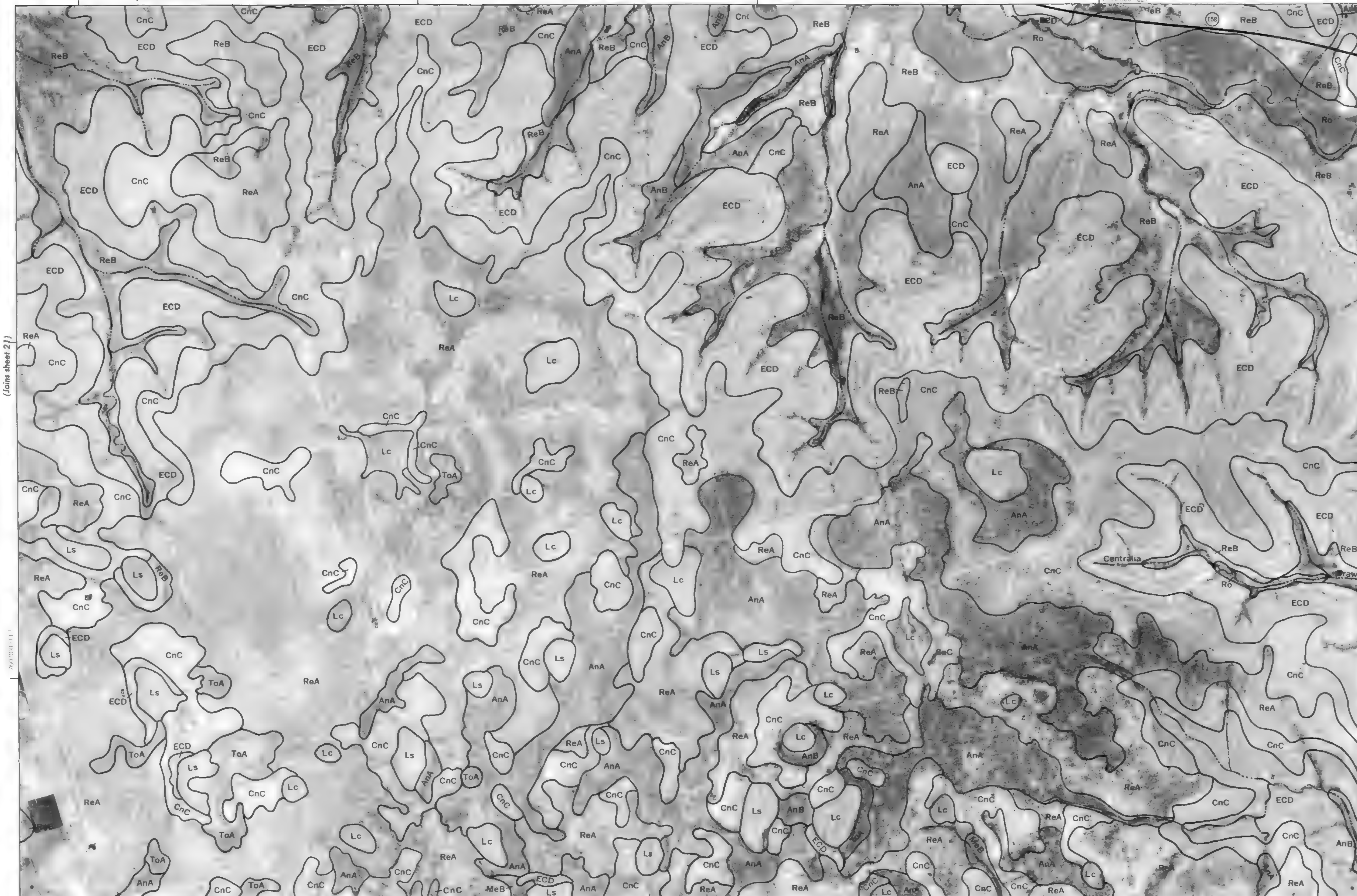
GLASSCOCK COUNTY, TEXAS NO. 21

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

22

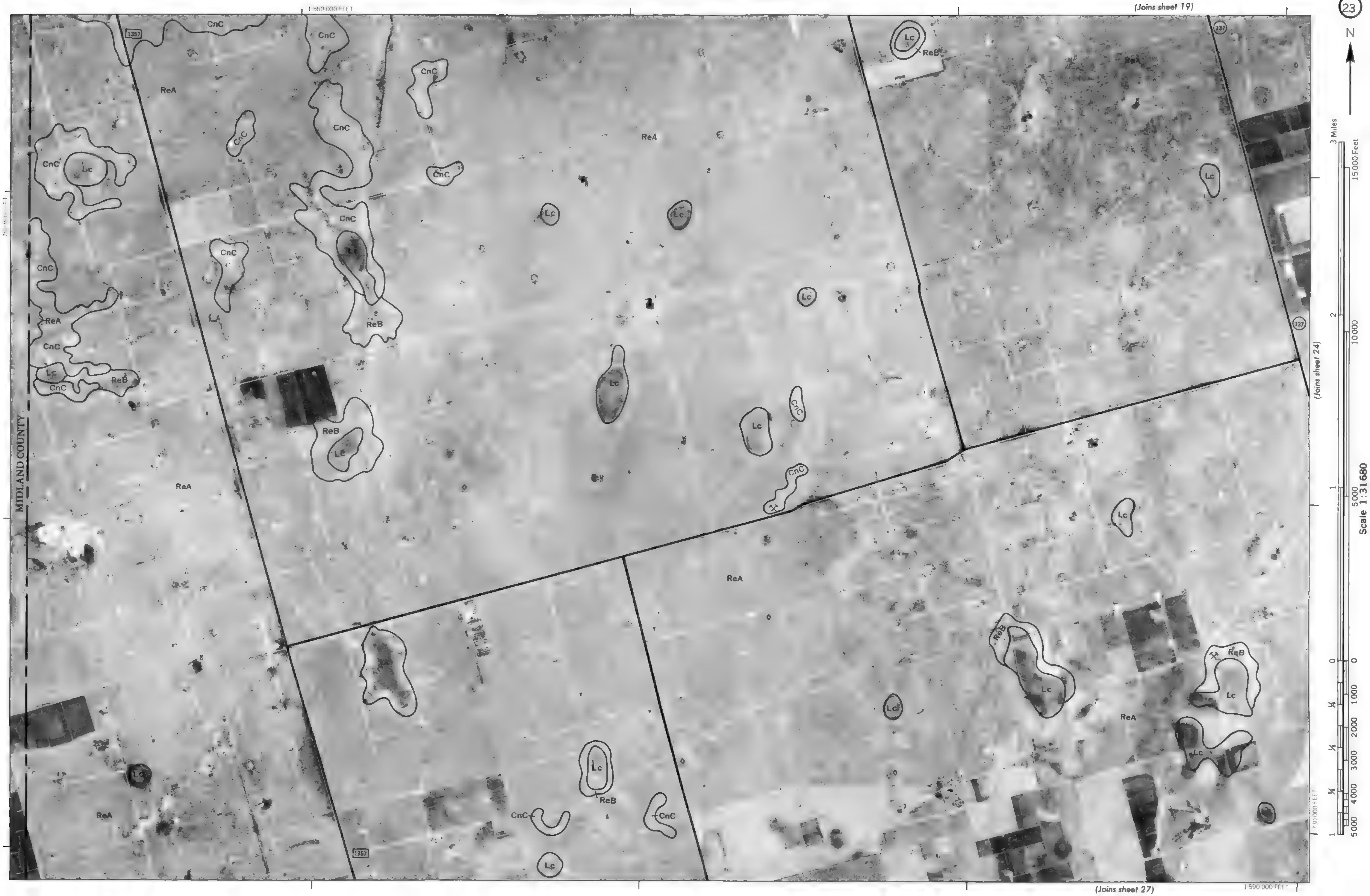
N

3 Miles
15 000 Feet
2
10 000
1
5 000
Scale 1:31 680
0
0
1000
2000
3000
4000
5000
1



GLASSCOCK COUNTY, TEXAS NO. 22

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

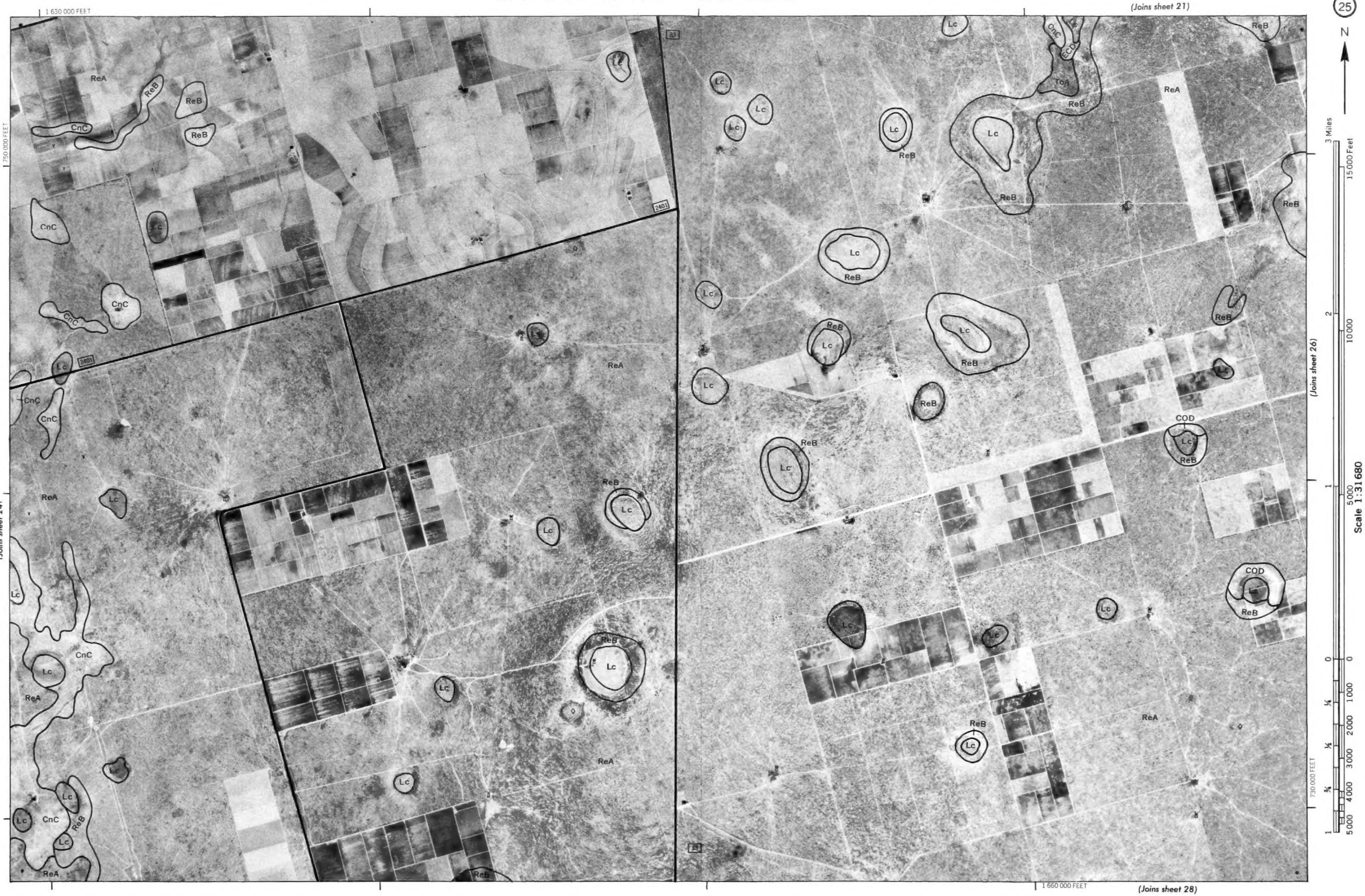


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

GLASSCOCK COUNTY, TEXAS NO. 23

GLASSCOCK COUNTY, TEXAS NO. 24

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

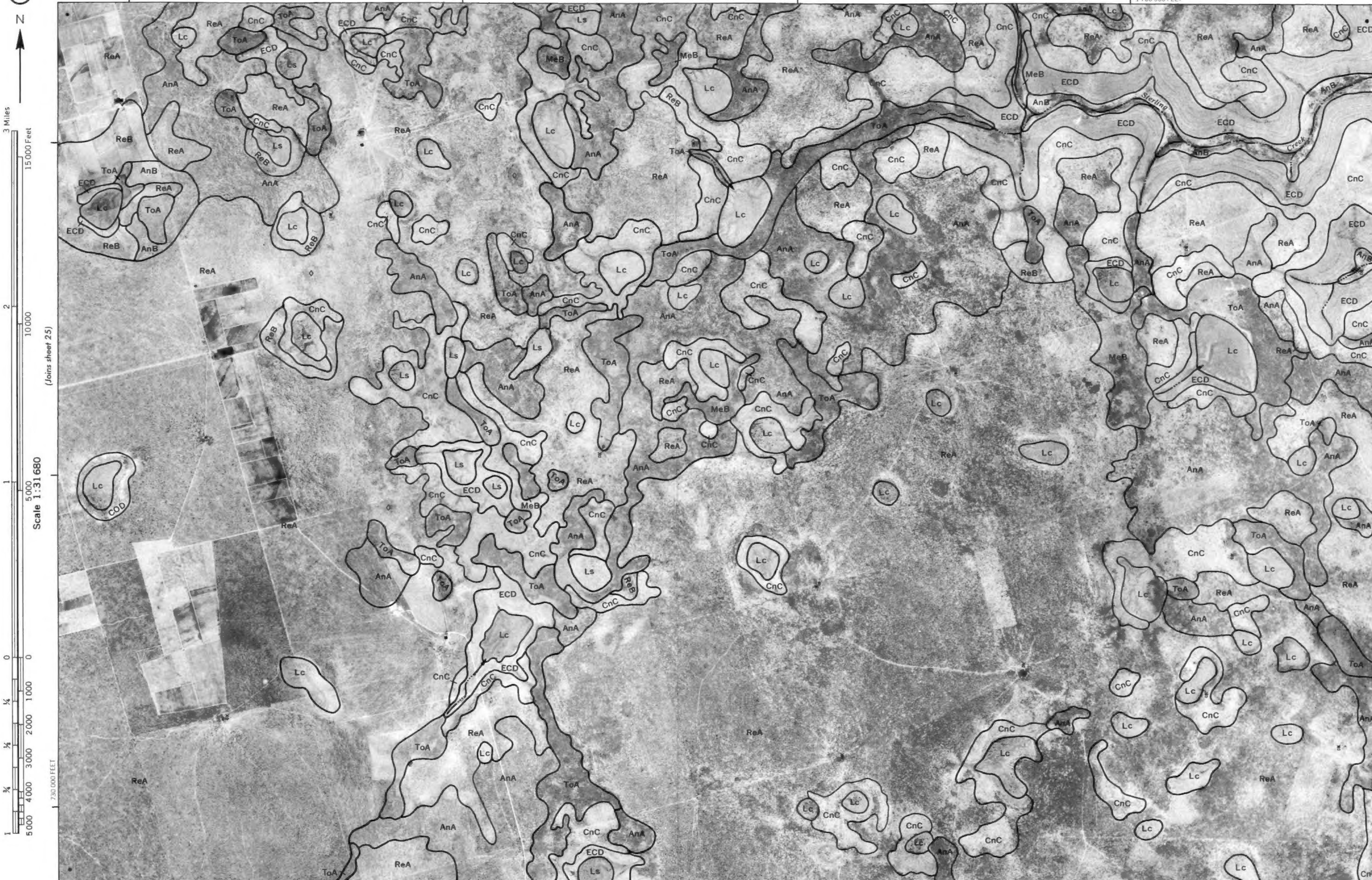


GLASSCOCK COUNTY, TEXAS NO. 25

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GLASSCOCK COUNTY, TEXAS — SHEET NUMBER 26

(Joins sheet 22)



(Joins sheet 25)

(Joins inset B, sheet 18)

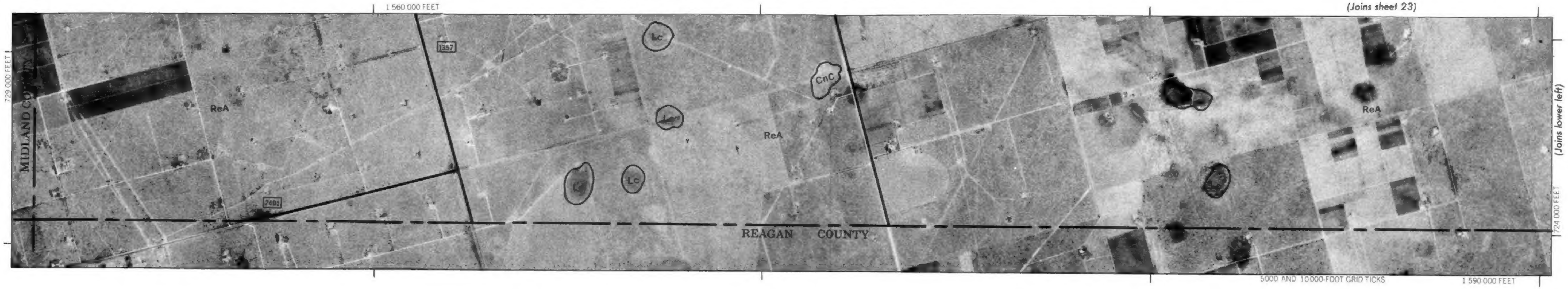
(Joins inset A, sheet 28)

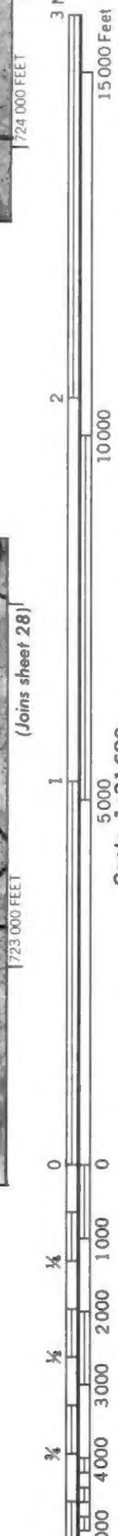
GLASSCOCK COUNTY, TEXAS NO. 26

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

27

N

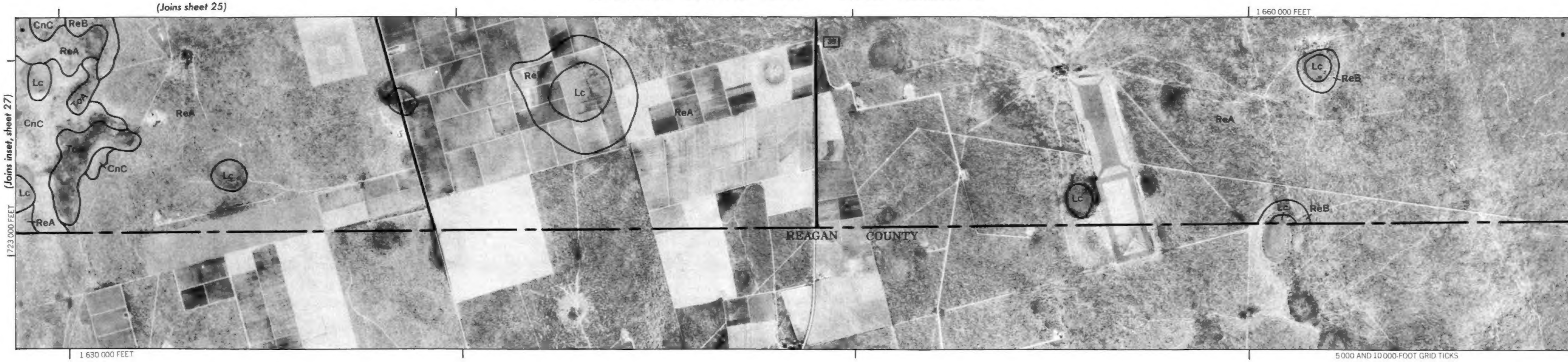


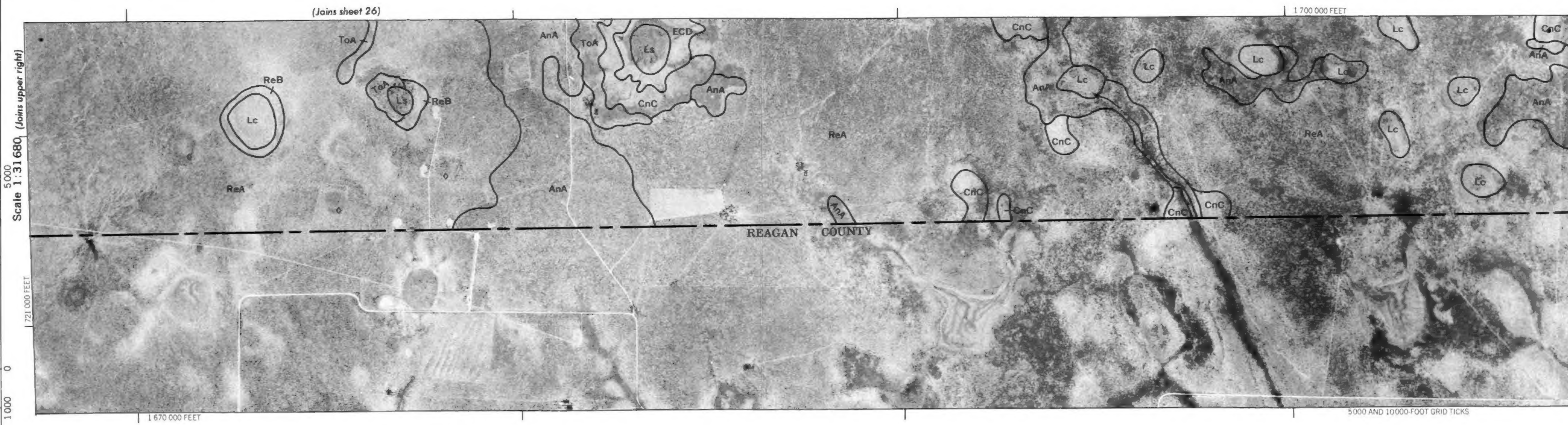


Scale 1:31 680

GLASSCOCK COUNTY, TEXAS NO. 27

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





GLASSCOCK COUNTY, TEXAS NO. 28

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